ANNALS OF SURGERY

ORIGINAL MEMOIRS.

LYMPHATIC CONSTITUTION. CARE OF THE LYMPHATICS DURING AND AFTER SURGICAL OPERATIONS.[1]

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THE dual title of this article is necessitated by the relation existing surgically between the two subjects.

The subject of this paper was suggested to me about a year ago by the unfortunate result following an ordinary operation for the removal of a few lymphatic glands from the axilla of a child. An outline of the case is as follows:

Several months before I saw the boy, aged about six or seven years, the glands in the axilla became inflamed, and finally suppurated; the abscess opened and discharged, and eventually healed to a very small sinus, which continued to discharge. The patient was referred to me by Dr. Joseph E. Winters. On examination, I could readily feel a number of glands against the chest wall, and there was present a small and short sinus. I thought it possible to close it by local treatment without operation, which the family wished to avoid, so I treated the patient by ordinary

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[1] Read before the New York Surgical Society, January 13, 1904.

means for several weeks, during which the sinus became still smaller, as also the glands. At a certain stage, however, there was no further progress, so I decided to operate. During my treatment the boy developed whooping-cough, but this had subsided at the time of operation, and the patient was practically well of it.

During the operation chloroform was used as the anæsthetic because of the greater ease of administration to so restless a child, and because of some remaining bronchitis. Personally, I have a strong preference for ether, even in children, and habitually use it as the safer anæsthetic of the two.

I removed the sinus and several glands more or less broken down and resembling the usual tubercular glands. I encountered unusually little bleeding; only two or three clamps being used, which were removed at the close of the operation without the necessity for tying any vessels.

The operation was completed about twelve o'clock noon, the boy being left in very good condition. I had a telephone message in the evening that the patient was slightly restless, but otherwise doing well. At three o'clock the next morning, I was called to the telephone by the nurse, who reported a temperature of 103° F., rapid pulse, great restlessness, and some delirium. When I reached the boy, within half an hour, I found the report to be true, and that the condition had been coming on gradually for several hours. The dressings and wound were all right. Dr. Winters arrived about five, and a conjoint examination brought us to the conclusion that the trouble was cerebral. Everything possible was done for the child, but the temperature gradually rose to 105° F., the delirium continued and increased, coma succeeding the delirium, until the end, which occurred about twelve o'clock, twenty-four hours after the operation.

The very unusual and rapid termination from such a comparatively common and simple operation was of course unlooked for, and has caused me much thought with a view to the cause.

The patient was of an extremely nervous temperament and rather unmanageable. He was of fair complexion, somewhat anæmic; and the surface lymphatic glands throughout the

body were palpable. A casual inspection of the mouth and pharynx showed a chronic enlargement of the tonsils and thickening of the pharyngeal membrane.

After canvassing the symptoms most carefully and hunting for the cause most diligently, the thought occurred to me that perhaps infectious material had been carried to the brain. No arteries of appreciable size were cut; the veins cut were most minute, were immediately clamped, and did not bleed when the clamps were removed; and it seems, if infection had taken place, it must have been through the lymphatics.

In some of its features the case presents a similarity to the reported cases of lymphatic constitution, and I would be quite willing to consider it such, provided another condition were added,—that of infection.

My case presented the superficial symptoms of fine silky hair, fair complexion, enlarged surface lymphatic glands; and enlarged tonsils and adenoids; also some anæmia, and the peculiarity of unusually little bleeding at the time of operation. All of these favor the diagnosis of lymphatic constitution.

The child bore the anæsthetic remarkably well, although it was somewhat hard to control in the preliminary stage.

Three symptoms after operation stand out prominently,— the high temperature, the delirium, and the rapid termination.

Of the reported cases, one by Dr. Blake (ANNALS OF SURGERY, 1902, XXXV, 745), in a paper read before this Society about a year ago, resembles mine most nearly. It was one of operation for phimosis on a boy of two and a half years. Chloroform anæsthesia; condition good immediately after operation. Slight restlessness during the night. Pulse weaker towards morning (132). Drowsiness, coma, and death twenty-three hours after operation. The highest temperature was 101.4° F. My case resembles this one, except that in mine the temperature was higher (105° F.) and the delirium marked.

Some of the fatalities reported occurred during anæsthesia and before the operation was begun, others at a variable time after operation, and still others where no anæsthetic was given nor operation performed, as in several sudden deaths reported

by Nordman and Paltauf of persons who fell into the water, but whose deaths were not due to drowning.

It would seem to me that Halstead ("Anæsthesia in Children," *Philadelphia Medical Journal,* 1900, Vol. vi, 859) strikes very near one of the roots of the matter in saying, " Chloroform, fear, shock, are all strong cardiac depressants; any one of the three capable of producing death through cardiac syncope, and when all these are combined, as is often the case in anæsthetizing frightened children, the patient is necessarily in a critical condition at the very beginning of anæsthesia."

Taking the symptoms of lymphatic constitution so far as they are known, and considering those which can be readily diagnosed, plus others which may be suspected, it would appear to me that the condition is probably very common. That perhaps we are hunting too wide for the cause of death, and that in constitutio lymphatica we have simply a weakened condition, low vitality, and slight, if any, recuperative power.

Struma is, I believe, considered to be the forerunner of tuberculosis, or even a tubercular condition in which the disease is very slowly progressive and inactive. The general symptoms resemble the lymphatic constitution so closely that one is struck by the similarity, if not identity, of the two. The question arises as to whether or not constitutio lymphatica may not be a tubercular condition of still more inactive form; a condition presenting everything favorable to the development of tuberculosis, and perhaps really of tubercular origin. I presented this idea to Dr. Ewing, Pathologist to Cornell University, in a recent conversation, and he expressed the opinion that it was possible that future investigations would prove lymphatic constitution to be a tubercular condition.

Assuming the above reasoning to be correct, it would seem that constitutio lymphatica must be a general condition, and an exceedingly common one. An examination of our dispensary patients will reveal many cases presenting all the symptoms of the condition obtainable before death.

If this be so, many cases of lymphatic condition must have been operated on and have recovered. The diagnosis has been

made by autopsy.   At the autopsy stress is laid on the presence of an enlarged thymus gland, but I am assured by Dr. Ewing that the condition may exist without such enlargement.

Hence, in constitutio lymphatica we have a general condition of low vitality, of predisposition, of slight resistance, together with an extremely fertile soil for the propagation and development of pathogenic bacteria.

Given this condition, we must change our prognosis and assume a graver one in the presence of any work involving fright, shock, or possible infection.   This last possible infection is, I think, a cause of death which must be considered prominent in some cases.   I refer to the possibility of the introduction of foreign material through the lymphatics at the time of operation.

In the case I report, we had a nervous, lymphatic child, no doubt of lymphatic constitution.   Chloroform, fear, and shock were present; and besides these there was, in my opinion, based on the subsequent temperature and delirium, an absorption of material from the wound through the opened lymphatic spaces and vessels.   I need hardly say that the usual precautions were taken to prevent infection from the outside, so that if infection there were, it was of material already present in the operative field.

One of Dr. Ewing's cases (" Lymphatic Constitution," *New York Medical Journal,* 1897, Vol. lxvi, p. 37) might have been due to such a cause.   It was a case of childbirth, shock, and hæmorrhage; head of the child torn off during version, all before admission to the hospital.   On admission, the uterus was cleared, etc.   Death in fifteen hours.   The shock and hæmorrhage were not considered sufficient to cause death, which was attributed to lymphatic constitution.   If we should add the probable absorption, through the wide open lymphatics, of the uterine contents, we would have another very likely cause.

We are familiar with the fact that infection is most commonly carried through the lymphatic system; but the only care we take to prevent such an event during operative work is to cut clean and not tear tissues.   In malignant disease, for

instance, our best operators urge a clean dissection, and urge the use of the sharp end of the knife rather than the blunt end. This is no doubt good advice, as it is meant that the growth shall be entirely removed. But is it not possible that the very method which is seemingly best may be the means of a recurrence? Is it not possible that by cutting methods the spaces and vessels are opened more widely and through them infectious material finds its way into the general circulation? It is almost, if not quite, impossible to prevent some contact of infectious material with the clean surface of the wound during operation; and if reinfection does not occur more often, it may be due to other reasons rather than to protection at the time of operation.

If one considers the clinical course of an acute suppurative inflammation, we find in the presence of confined pus that the neighboring lymphatic trunks and glands are rapidly involved. Take the ordinary felon as an example. The more acute, the more rapid the involvement. Bacteria as well as many other animate things, even of a higher order of intelligence, follow the paths of least resistance. While the pus is confined, the pressure is greatest along the marginal lymphatic spaces, and the extension is in that direction; when the abscess is opened, the pressure is removed and the natural flow is to the outside; but there are no doubt some bacterial individuals who prefer not to mingle with the multitude; and there are others who are already started along the natural lymph channels; these are carried along by the current to start new foci elsewhere, or to be eliminated.

We take very good care that all bleeding vessels shall be occluded by ligature or otherwise; but the lymphatics, whether spaces, vessels, or glands, are left to take care of themselves. It seems to me it would be a step in the right direction to give some heed to possible infection through these sources, and to take such steps as possible to close such orifices not only at the time of operation, but subsequently.

I have acted on that plan for the last year, and, while I cannot prove it has made any difference in my results, I feel

assured that it has had an effect, and it is possible my cases would not have done so well had I not followed a certain plan, which I detail as follows:

Care of Lymphatic Vessels.—In operating on diseased glands, I have dissected them to the point of exit of the vessel, which I have then tied as I would an artery or vein. This has also had a value, as the arterial supply enters at about the same point as the emergence of the lymphatic, and there has been less hæmorrhage than otherwise. It has also facilitated the work in that the vessels, lying usually towards the bottom of the wound, dissection is more difficult, and if bleeding occurs, it is more difficult to control; but if dissection is carried to that point and a ligature is thrown about the pedicle, as it were, much time is saved.

As I have said, I cannot attribute any special value to the above procedure, judging from results; but I can state that all of my cases have done as well as the best heretofore, and the method has done no harm. On the other hand, I feel, had I not followed the above plan, I might very likely have had other results in some of the cases.

Care of the Lymphatic Spaces.—These I care for in one of two ways, and will use as illustrations a case of empyema and one of abscess, such, for instance, as suppurative appendicitis.

When a good deal or all of the work can be done before the abscess is opened, as in a case of excision of a piece of rib for empyema, I do all that is possible in the cleanliest manner; then, before opening into the pleural cavity, I rub sterilized vaseline or a thick ointment, such as iodoform ointment made with vaseline or lanoline, thoroughly over all of the raw surface. I think this occludes the lymphatic spaces and smaller vessels until such time as there is no longer danger of absorption through them. The chest is then opened.

In case of ordinary abscesses, as soon as the pus is evacuated and the cavity washed out, I swab it dry, and throw in enough ointment or vaseline to fill it. This is not a new method, but its use has been more confined to treatment of suppurating bubo than to abscesses elsewhere.

Next, in the after-treatment of infected cases, such particularly as have cavities, it is my custom to fill them with ointment at each dressing or occasionally, as may be. The ointment should be something which at least will dissolve; hence, I would not recommend bismuth or oxide of zinc; on the other hand, there should not be enough poisonous material in the ointment, such as iodoform, to affect the patient.

I would again say I could reach no conclusion as to the value of the methods employed, as all of the cases did well; hence, a detailed report of cases would be a waste of your time and have no value. But the impression I have received is that my cases have done better, have run less temperature, have had less local symptoms, and have had fewer complications where I have used the above methods than where I have not. Take, as an illustration of a slight but annoying complication, two recent cases of empyema; the one treated as outlined, the other simply opened in the ordinary manner; the first case shows no irritation in the wound or about it; the second at this writing is angry looking and the surrounding skin is excoriated to a marked degree.

I think the methods eliminate, in part at least, one of the causes of death in lymphatic constitution, and I have sufficient confidence in them to recommend them for consideration.

PULSATING EXOPHTHALMOS DUE TO TRAUMATIC ANEURISM OF THE INTERNAL CAROTID ARTERY.

REPORT OF A CASE CAUSED BY A BULLET WOUND OF THE BASE OF THE SKULL.

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OF LONDON,

Assistant Surgeons to the London Hospital.

W. C. was a ne'er do well, aged forty-two years, who shot himself in the mouth with a revolver, and was found bleeding from the mouth, nose, and left ear in a field thirty-six hours after the injury was inflicted. Dr. Denning, of Epping, under whose care he came on October 16, 1901, sent him up to the London Hospital under my care.

When he was admitted on October 16, 1901, a ragged wound was found running upward and backward through the tuberosity of the superior maxillary bone to the base of the skull, which was perforated and smashed in the region of the left petrous bone. The wound was foul and the breath fœtid. The left side of the face was paralyzed completely. The left eye was protruded and the pupil dilated and fixed. Complete external ophthalmoplegia was present and the left cornea was insensitive, the eyelids were swollen and very prominent. When the eye was palpated, it was found to be pulsating vigorously; a thrill was present, and a bruit was heard with a stethoscope over the eyelids. On compressing the carotid in the neck the eye receded and the pulsation disappeared. The conjunctiva was œdematous, and soon this œdema increased so much that the mucous membrane herniated between the lids.

The left side of the face was completely paralyzed, but the movements of the palate were normal. The sensation of the face and neck was unimpaired and the movements of the tongue unaffected. Blood and cerebrospinal fluid escaped from the left ear, and the patient was quite deaf on that side.

Mr. Rigby kindly saw the case with me, and we decided it would be best to ligature the left common carotid, and so attempt to save the left eye, and at the same time cure the arteriovenous communication which we supposed existed. To ligature the common carotid in a case of arteriovenous communication in the cavernous sinus which has existed for a long time is not a rational procedure, for one of two things may occur. Either the collateral circulation is good, in which case the exophthalmos will relapse almost immediately, or it is not good, when hemiplegia from anæmic softening will result.

In this case, however, the aperture of communication was recent, and, could we reduce the blood-pressure in the carotid for even a few hours, this aperture might well become closed permanently.

Operation.   Ligature of the Left Common Carotid; Slipping of the Ligature; Method of Resecuring the Artery.—The left common carotid was accordingly ligated in two places and divided between the ligatures opposite the cricoid cartilage and through a small wound. When the ligature was tied, the respirations immediately became deep and slow ; the proptosis diminished and the pulsation in the upper and lower lids disappeared. The left pupil slightly dilated, but remained immobile to light. Feeble pulsation could be felt in the superficial temporal artery on the left side, and the superficial temporal veins were very prominent.

I am now aware that several errors were committed in the technique of this ligature. The artery should have been ligated in continuity, and there was no need to divide it. Division of large arteries between ligatures was a method introduced, I believe, by Sir Thomas Smith. It was intended to permit the ends of the artery to retract up the sheath, away from a wound which would certainly become septic, thus diminishing the risk of secondary hæmorrhage. Now that primary wounds heal uniformly by first intention, it is unnecessary to continue this procedure.

The wound was too small, and the sheath was only opened three-quarters of an inch, and, as a consequence, the two ligatures converged below the artery, and were no doubt tied obliquely around it, and certainly not more than one-eighth of an inch of divided artery projected beyond the central ligature.

I must, however, claim to have tested the central ligature fairly well by pulling on it before I cut it short and let the artery retract.

Whilst the wound was being closed, blood suddenly spouted up in great volume from the depth of the wound. I immediately plunged my right index down to the carotid sheath and plugged the hole in it with the tip of my finger. This practically stopped the hæmorrhage, but the anæsthetist had been told to discontinue the anæsthetic; the patient was coming round, and the rough pressure on the vagus caused spasm of the glottis and of respiration. A minute or so was spent in getting the patient deeply anæsthetized, and then I attempted to secure the artery by three distinct plans, only the last of which had any real chance of success.

First, I tried to grip the artery through the sheath below my finger with Spencer Wells forceps, but the sheath only slipped upon the artery, which indeed had retracted about an inch and a quarter.

Then I enlarged the wound with my left hand and tried to open the sheath below the end of the artery and secure the artery there, but I found the sheath infiltrated with blood at arterial pressure, and the first small aperture in the sheath I made spurted like an artery, and had to be secured with forceps. It was then that I saw that if the artery was to be secured at all, it must be low down where it left the thorax. I accordingly continued my incision to the sternum, separated and cut across the sternomastoid and omohyoid, operating all the time with my left hand. I then followed the pulsation of the carotid backward until it entered the thorax, and here compressed it against the body of the seventh cervical vertebra. On removing the right index, which had plugged the hole in the sheath all this time, no hæmorrhage occurred. Then taking a fine pair of scissors in the right hand I slit the sheath carefully down its inner side so as to avoid the internal jugular, which was distended from the pressure below. After slitting up the sheath for about three-quarters of an inch, the ligature was encountered, and about half an inch farther the round yellow end of the artery came into view. It was drawn out and secured by Spencer Wells forceps, and finally ligated with No. 4 silk. I have gone at some length into this accident because it is one which may occur to almost

any operating surgeon who divides large arteries between ligatures, and, secondly, because I have heard of two cases in which it happened to very eminent surgeons, and the artery was not secured, apparently because they restricted their efforts to the neighborhood of the wound in the sheath.

Progress.—The wound in the neck healed aseptically. The pulsation of the eye disappeared for four days; it then recurred, and finally disappeared about ten days after the ligature; but by this time the eye was blind and opaque.

For two months the progress of the case was uneventful. The profuse flow of pus from the mouth and ear gradually diminished. Boric acid syringed into his ear came out of his mouth. The temperature oscillated, but there were no cerebral signs.

The bullet had been localized by skiagrams taken transversely and anteroposteriorly, and was known to be lying at a depth of one and a quarter inches just above the petrous bone, and probably in the temporosphenoidal lobe. I did not attempt to remove it during this period, because I thought an arteriovenous communication might still exist, and that I might find the thin veins of the cortex distended and pulsating at high pressure and too frail to hold a ligature.

Just two months after admission the patient began to complain of headache, and his temperature rose to 100° F.; and on the following day he had a right-sided fit, chiefly limited to the face and arm and followed by decided weakening of the right-hand grip. The fit lasted seven minutes, and he was unconscious for four hours after it.

It was decided, in consequence of this fit, to remove the bullet and drain an abscess which was believed to exist around it.

Operation to remove the Bullet, December 24, 1901.—The first thing we did was to exactly locate the bullet by means of X-rays and the fluorescent screen.

On his way to the theatre, the patient was wheeled into the dark room and the X-rays of a Röntgen tube were directed exactly transversely across his skull.

The bullet could be clearly seen on the screen. A pin was then thrust through the screen in the middle of the bullet shadow until it impinged against the scalp. The lights were turned up and this spot marked with aniline dye on the scalp.
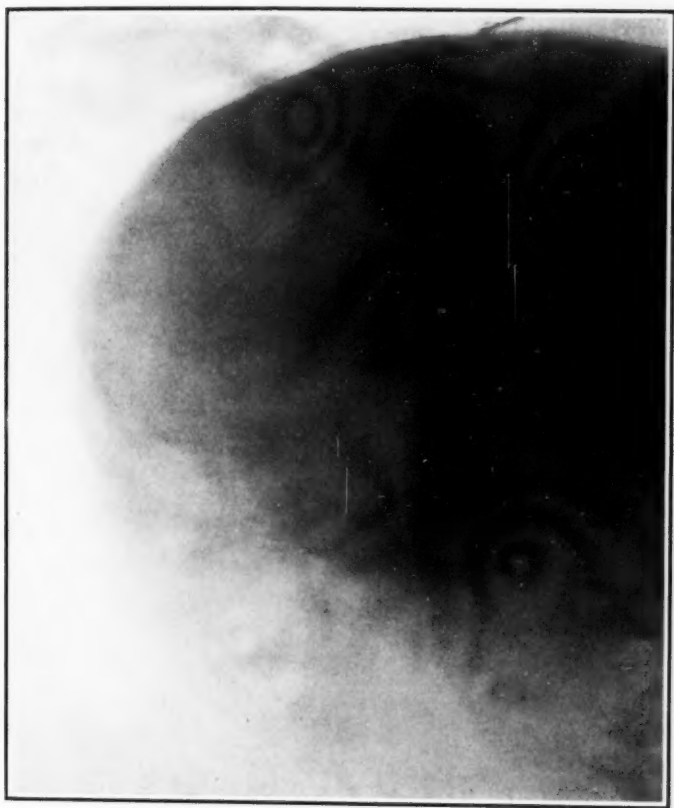
FIG. 1.—Skiagram of the skull of case of pulsating exophthalmos taken transversely, showing : (1) Bullet one and one-half inches vertically above the external auditory meatus. (2) The track of the bullet through the base of the skull.
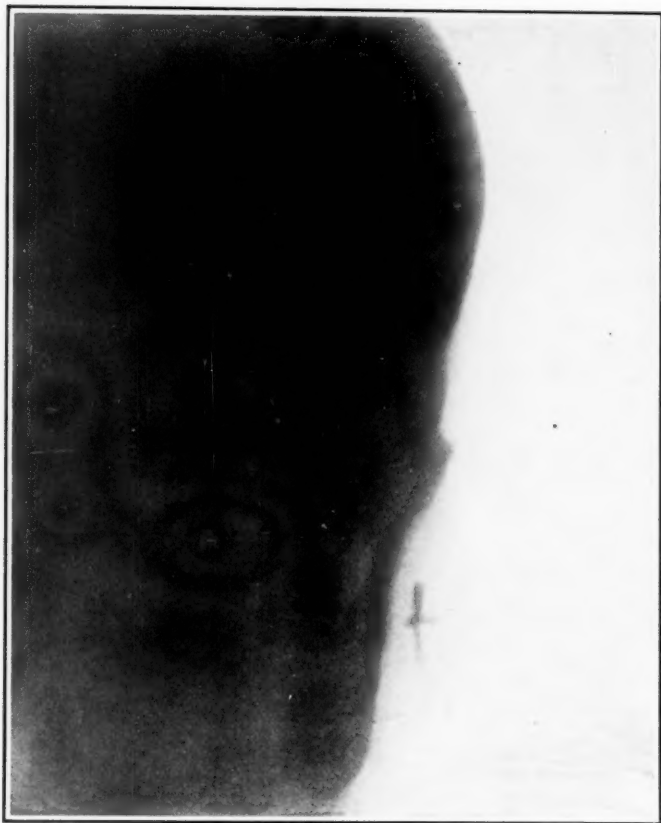
FIG. 2.—Skiagram of the skull of case of pulsating exophthalmos taken anteroposteriorly, showing bullet misshapen at a depth of one and one-half inches from the squamous bone, and one and one-half inches above the external auditory meatus.

This point was one and a half inches above and slightly behind the external auditory meatus.

In the theatre, this point was marked on the skull by a steel pin driven through the scalp. A flap was then turned down and the pin of the trephine applied to this point. A disc of bone no larger than a shilling was removed. The dura was incised and a director passed transversely across the brain. At a depth of three-quarters of an inch gas and foul pus escaped, and the director struck a sharp object, which was seized with forceps and removed. It was found to be a separated portion of petrous bone. The wound was then enlarged with forceps and much pus evacuated, and the little finger inserted into the abscess cavity. At a depth of one and a half inches the bullet was felt lying on the top of the petrous bone and still entangled in the dura with several small fragments of bone. It was removed. The abscess was irrigated out and a drainage tube inserted. The patient improved for a day or two, and then a hernia cerebri developed, and his temperature and pulse became subnormal. The brain was explored cautiously, but the abscess cavity was apparently efficiently drained.

He died with signs of cerebral compression two months and a half after the accident.

Autopsy.—A large abscess was found in the upper part of the temporosphenoidal lobe extending into the lower part of the Rolandic area. It was as large as a Tangerine orange. It did not communicate with the abscess around the bullet, which was efficiently drained. Apparently it had originated in the bruised area in front of the bullet, and was perhaps partly due to the anæmia produced by the ligature of the common carotid.

The left half of the skull as far back as the petrous bone was removed for careful dissection of the causes of the pulsating exophthalmos.

Mr. Hugh Rigby very kindly undertook the dissection, and has contributed the description which follows.

The illustration is by Mr. T. Wood Jones. The skiagrams and photograph of the bullet by Mr. Hamack.

Report of Dissection, and Remarks by Mr. RUGBY.—There is a small circular hole situated on the inferior surface of the zygomatic surface of the great wing of the sphenoid left side.

A probe inserted into this, passed upward, backward, and slightly outward, and finally appeared at the ragged opening seen on the upper aspect of the base of the skull at the tegmen tympani. It must have passed in front and just external to the first curve in the intracranial course of the internal carotid in the apex of the petrous portion of the temporal bone. It likewise must have crossed obliquely and antero-externally to the left Eustachian tube and beneath the left Gasserian ganglion.

The superior maxillæ and pterygoid processes of the sphenoid bone had at the post-mortem examination been sawn off flush with the base of the skull. The path of the bullet from the palatal surface of the superior maxilla was up and back through the posterior part of the tuberosity of the superior maxilla and the pterygoid process to reach the zygomatic surface of the great wing.

On examining the base of the skull from above, a ragged hole about the size of a half-penny was evident at the site of the left tegmen tympani. There was an inch trephine hole in the squamous part of the left temporal bone. The only other thing to notice on the surface was a hard, firm, rounded swelling at the posterior part of the left cavernous sinus; this was thought to be a thrombosed cavernous sinus. A dissection was now made to expose the internal carotid artery in the whole of its intracranial course; at the post-mortem examination the supraoccipital had been separated from the exoccipitals with bone forceps. The basioccipital was cut through in a line from the anterior extremity of the condyle of the occipital to the posterior wall of the carotid canal, at the posterior end of the cavernous sinus. In this incision the inferior and superior petrosal sinuses were necessarily divided; they did not show any change from the normal.

A second incision was next made from the posterior condyloid foramen obliquely forward and outward to the jugular foramen.

The piece of bone (exoccipital) between the two cuts, foramen magnum posteriorly and petrous of temporal anteriorly, was then removed; the bulb of the lateral sinus was next opened up; this and the lateral sinus itself were quite normal. The portion of the petrous forming the inner wall of the carotid canal
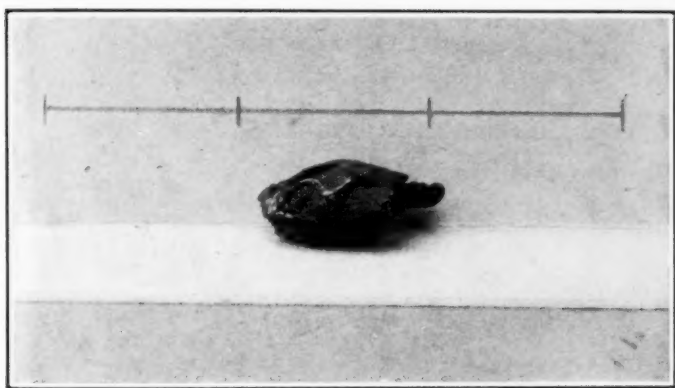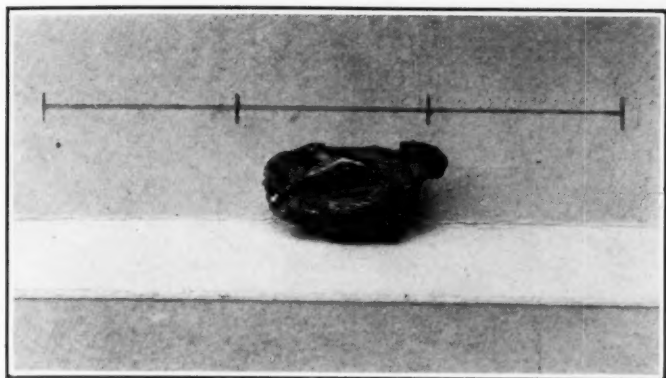
FIG. 3.—The bullet extracted from the brain of case of pulsating exophthalmos.   Actual size.
The scale is in inches.

was next chipped away with the forceps and the carotid freely exposed from behind, from the entrance on the inferior aspect of the petrous to its exit on the lateral wall of the basisphenoid.

The Cavum Meckelii was next opened up and the Gasserian ganglion removed, the three divisions having been divided close to their exit from the skull. The cavernous sinus was next
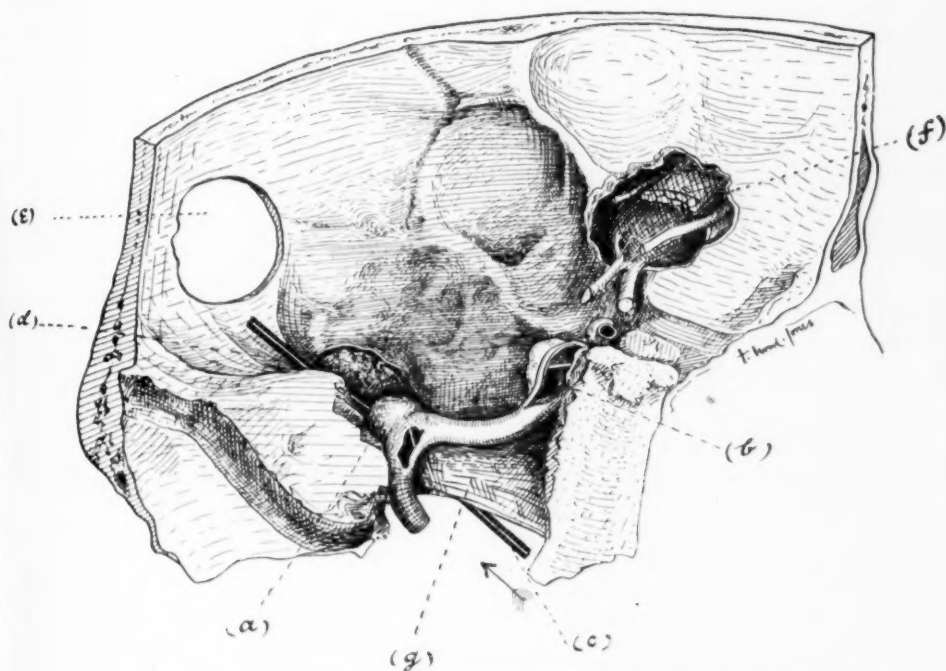
FIG. 4.

Diagram of a dissection of the specimen obtained from Mr. Barnard's case of pulsating exophthalmos, showing the left internal carotid artery in its intracranial course. The lumen of the artery has been opened up to show the mouths of the aneurismal sacs from within. The contents of the left orbit have been dissected from above.

The following are the points of interest in the diagram: *a*, Sacculated aneurism at the first bend of the internal carotid in the petrous bone adjoining the exit of the bullet in the middle fossa; *b*, sacculated aneurism at the second bend of the artery at the posterior part of the left cavernous sinus; *c*, glass rod indicating the track of the bullet, which passed from below upward; *d*, ragged hole in the tegmen tympani caused by the exit of the bullet; *e*, trephine hole in the squamous bone through which the bullet was extracted; *f*, the contents of the orbital cavity dissected from above; *g*, the Eustachian tube.

displayed by dissecting off the dura mater and the nerves on its outer wall.

The carotid exposed by this dissection was seen as follows. At the antero-external side of the artery at its first bend in the canal in the petrous bone was situated a small, well-defined sacculated aneurism filled with firm clot. Another aneurismal swelling, localized, oval, and filled with firm clot was situated on the outer side of the artery in the posterior half of the left cavernous sinus; the third, fourth, ophthalmic division of fifth, and sixth nerves were stretched on its outer wall.

The cavernous and the other sinuses in this region were small and empty of blood. No communication between the internal carotid artery and the cavernous sinus could be made out. The sphenoidal fissure was next opened up and the orbital plate of the frontal bone and lesser wing of the sphenoid cut through so as to expose the orbital contents from above; the fourth nerve, levator palpebræ, and superior rectus were divided and turned forward; the superior ophthalmic vein was then exposed; it was not enlarged, and contained practically no clot. The ophthalmic artery was small and quite empty. The optic nerve was intact, as were also the rest of the orbital nerves. The sheath of the optic nerve was more adherent than usual.

The chief points to note in this dissection are:

(1) The presence of a double sacculated aneurismal dilatation in the intracranial course of the internal carotid artery.

(2) That no arterial communication with a sinus was present.

(3) That, although the aneurismal sac in the petrous bone could be accounted for by the fracture of the tegmen, no such explanation can account for the aneurism found at the posterior part of the cavernous sinus. No radiating fracture across the base could be detected.

(4) The absence of any noticeable dilatation of the sinus or ophthalmic vein.

The interest of this case I think depends chiefly on the fact that all the typical signs of a traumatic pulsating exophthalmos were found to be due to a sacculated aneurism of the carotid, and not to an arteriovenous communication. That an aneurismal dilatation of the internal carotid in its intracranial course

can give rise to this condition has been much disputed. A refer-
ence to the best known articles on this subject leaves one greatly
in doubt whether such a condition is possible.

Mr. Rivington's paper is perhaps the earliest series of such
cases recorded; this appeared in the *Medico-Chirurgical Trans-
actions* in 1875, Vol. lviii, p. 183.

He there gives an excellent *résumé* of the previous litera-
ture dating back to 1809, when the first recorded case of liga-
ture of the common carotid for this lesion is published.

Rivington's paper consists of seventy-three cases, which
include all those recorded up to that date, viz., 1873. He bases
the paper on a most interesting case in which digital com-
pression, perchloride of iron injections, and, finally, ligature of
the common carotid was performed, with a completely satis-
factory result. Among these cases he quotes the results of
twelve post-mortem examinations.

In no case was there found a simple traumatic aneurism on
the internal carotid.

In ten the lesion was situated behind the orbital cavity.

In three traumatic cases there was a direct communica-
tion between the artery and vein.

In one case there was found an aneurism of each oph-
thalmic artery.

In three " idiopathic cases" there was found a rupture of
an aneurism of the internal carotid in the cavernous sinus.

In one case a simple dilatation of the artery.

In eight cases the ophthalmic veins were found enlarged
and varicose.

He concluded from the post-mortem examinations that

(1) The most usual lesion found is a direct communica-
tion between the artery and vein.

(2) That no case was found due to a traumatic aneurism
of the internal carotid.

He further points out how an aneurism of the internal
carotid in the cavernous sinus may exist without any signs of
intra-orbital aneurism. In support of this, he quotes a case of
Mr. Holmes and a case of Mr. Jonathan Hutchinson's.

In the latter case, a woman aged forty years, had a circumscribed sacculated aneurism springing from the outer side of the left internal carotid in the cavernous sinus. The sinus appeared to be obliterated. There were no orbital signs except those due to pressure on the third, fourth, and fifth nerves.

In the *Lancet,* 1896, Vol. i, 1559, Mr. Rivington further makes the dogmatic statement, in reply to a paper published by Mr. Walker, *Lancet,* London, 1894, Vol. i, pages 191–193,—

(1) That true pulsating exophthalmos cannot be caused by a circumscribed or fusiform aneurism of the internal carotid.

(2) That the symptoms only appear if the artery ruptures and the blood enters the veins.

These opinions are also stated in Heath's " Surgical Dictionary" in 1886, though here he admits that a case quoted by Dr. Dempsey, of Belfast, in which an anerism of the ophthalmic artery existed, modifies his conclusions somewhat.

The next important paper on this subject is by Professor Sattler, of Erlangen (Von Graefe and Soemish's Handbuch der Augenheilkunde). He collected 106 cases, including those of Mr. Rivington, and made a summary of the literature up to date, viz., 1887.

In four out of nineteen post-mortems, an arteriovenous aneurism was definitely found with tear of the artery in the cavernous sinus; his conclusions practically agree with those of Mr. Rivington.

An illustration of a dissection of an arteriovenous aneurism in the cavernous sinus appears in this article, the chief noticeable feature of which is the enormous dilatation of the ophthalmic veins.

Professor Leon le Fort, in the *Revue de Chirurgie,* 1890, p. 457, summarizes the results found in 100 cases.

In the traumatic cases he thinks that fracture of the base need not always exist as a cause of aneurism of the internal carotid. He is of opinion that the internal carotid in this region has a peculiar friability, which causes its coats to give way even after slight violence applied to the skull. This explanation might account for the aneurism found in our case

at the posterior part of the cavernous sinus. He considers that aneurism of the ophthalmic artery, aneurism of the carotid in the cavernous sinus, or rupture of the carotid into the sinus, give rise to almost identical symptoms.

As a means for diagnosis between the two latter conditions, he lays stress on two points.

(1) The existence of a " bruit de souffle" continuous with exacerbations is in favor of rupture of the artery, and that aneurism only gives rise to an intermittent bruit, Nélaton's sign.

(2) The pulsations in the former case are much more powerful than those in the latter; the direct flow of arterial blood into the veins causing a more marked result than a transmission simply of the systole and diastole of an aneurismal carotid.

He considers the commonest lesion to be rupture of the carotid artery in the cavernous sinus, and that the consequent abnormal development of the ophthalmic vein is the principal lesion and causes the chief symptoms. The results of eighteen post-mortem examinations of these cases are published in Norris and Oliver's " Hand-book of Diseases of the Eye," and as a result the following statements are made:

(1) In no single case of true aneurism of the internal carotid in the cavernous sinus were there found any signs of venous stasis exophthalmos nor pulsation during life.

(2) That most cases of pulsating exophthalmos consequent on extra-orbital lesions are due to rupture of the internal carotid into the cavernous sinus.

In the Middlemore lecture at Birmingham in 1898, Henry Eales attributes pulsating exophthalmos to an arteriovenous communication.

Ligature of Common Carotids.—The question of the advisability of ligature of the common carotid in these cases has well been a controversial one, as Mr. Barnard has pointed out. The treatment by ligature of a recent traumatic case differs widely from that of a long existing or idiopathic one.

In favor of the treatment by ligature, one can simply refer

to the numerous cases quoted in the literature in which this operation was performed with perfect results.

It is striking, also, to find how those who have contributed most largely to this subject are practically unanimous in its favor; *e.g.,* Mr. Rivington urges ligature of the common carotid in traumatic cases.

His figures are as follows: In 26 cases, 23 recovered, 14 were cured, 3 died.

In 44 cases, *i.e.,* idiopathic plus traumatic, the results were: 26 cases cured, 7 partial, 5 failures. In 17 vision was restored, in 3 the bruit persisted. Both carotids were tried in three cases.

He considers the operation is contraindicated in the very aged.

The return of symptoms after ligature he ascribes to

(1) Return of the flow on the same side due to deficient coagulation of the blood.

(2) The veins may close on the same side, but the blood reaches the other eye by the circular sinus.

(3) A fresh aneurism may appear in the opposite eye.

Professor Sattler says that ligature of the common carotid is *the* treatment for traumatic pulsating exophthalmos dependent on either of the three conditions previously mentioned.

Professor Le Fort is also strongly in favor of early ligature.

His statistics are as follows: Ligature of common carotids, 61 per cent. successful cases, 54 per cent. cured.

In compression of the common carotid 86 per cent. of cases were not improved. He goes farther, and says that if the exophthalmos is double, if the ligature on one side has failed, and if then pressure on the other side checks the pulsations and bruit, that one should not hesitate to tie the other carotid.

Henry Eales (*vide supra*) is of opinion that ligature of the common carotid is only indicated in the young, and in those whose life is seriously threatened. That in other cases ligature may be deferred because

(1) Cases have existed for years without hæmorrhage or any fatal symptom.

(2) There have been a few cases of spontaneous cure.

(3) Both carotids have been consecutively tied without success.

Mr. Walker, of Liverpool, in a paper in the *Lancet*, published 1894, p. 193, strongly urges early ligature of the carotid in these cases. The paper is based on the notes of two cases in which ligature was performed, the striking feature in one of these being the return of vision in the affected eye.

Mr. Walker is of opinion that in early cases, except in direct stabs and wounds from fragments of bone, the lesion is at the outset a traumatic aneurism of the internal carotid, and that in time this gives way and the blood enters the cavernous sinus.

Coggin, in *Archives Ophthalmic Society*, New York, 1883, p. 187, performed a post-mortem examination on a patient in whom ligature of common carotid was performed with subsequent hemiplegia and death.

He found the ophthalmic veins to be rather larger than usual, and a well-marked aneurismal dilatation of the cavernous portion of the internal carotid artery. The ligature was applied five weeks after receipt of injury, typical signs of pulsating exophthalmos were present.

The arguments quoted against the operative treatment for this condition are based upon

(1) The records of several cases in which physical signs and symptoms had existed for a prolonged period, with but little marked effect on the well-being of the patient or little danger to life.

The following very striking cases may be quoted as an example of this:

(a) Mr. Williamson, in *British Medical Journal*, 1894, Vol. ii, p. 806, showed a case in which the symptoms, bruit, venous dilatation, pulsation, etc., had lasted for twenty-three years. The lesion in this case was due to an injury to the head, with signs of fracture of the base of the skull.

(*b*) A case exhibited at the Ophthalmological Society by Mr. Adams Frost in 1882.

A man who twenty-eight years before had been run over by a wagon. Proptosis, pulsation, bruit, were present on both sides. No operative treatment had been attempted.

(*c*) In the *Ophthalmological Transactions,* Vol. ix, is a case reported by Adolph Brunner.

Sixty-five years' duration, dating from an accident when twelve months old. There was marked proptosis and pulsation, well-marked bruit, no subjective noises, nor cerebral disturbances.

(2) The recurrence of symptoms and signs after ligation.

This is found to have taken place in many cases. The pathological condition in these had lasted for some time, months or years; and no doubt the failure was in every case due to the collateral circulation having been well established.

A case published by Knapp, *Archives of Ophthalmological Society,* New York, p. 201, is a good example of this.

Mr. B., New York, seven years before sustained an injury to the head which led to symptoms of arteriovenous aneurism. The common carotid was ligatured, but feeble pulsation was felt forty-eight hours later. The protrusion of the eye, which had at first subsided, returned markedly, and the eye had to be enucleated two years later.

Professor Sattler quotes similar cases in his table, viz., Morton's, Fotheringham's, and Hansen's.

Mr. Reeve, in the *Transactions of American Ophthalmic Society,* 1904, mentions a case of single pulsating traumatic exophthalmos in which both carotids were ligatured with an imperfect result.

The risks incurred by ligation of the common carotid.

These are (*a*) Sepsis. (*b*) Hæmorrhage, either immediate from slipping of the ligature or recurrent from ulceration of the vessel wall. (*c*) Cerebral complications and hemiplegia.

Sir John Erichsen, quoted in Jacobson's " Operations of Surgery," says that in 25 per cent. cerebral symptoms occur,

either early or remote. In the aged and in those subject to atheromatous disease the percentage will probably be much higher than this.

Coggin, in *Archives Ophthalmic Society*, New York, 1883, p. 187, quotes a case of a patient, aged sixty-six years, in whom hemiplegia and death followed ligature of left common carotid five weeks after injury. In this case, P.M., optic vein rather larger than usual; there was a marked aneurismal dilatation of the cavernous portion of the internal carotid artery.

The two cases mentioned in Rivington's paper who succumbed were aged sixty-three and sixty-five respectively.

(*d*) The occurrence of blindness in the corresponding eye after ligature is reported by Sigrist in *Archives Ophthalmic Society*, New York, 1898, p. 542.

(1) In a case of ligature of the carotid for cancer of the tongue, embolism of the central artery of the retina on the same side followed with consequent blindness.

(2) In a case of traumatic pulsating exophthalmos the external and internal carotids were tied simultaneously; central artery embolism followed.

(*e*) Homonomous hæmianopsia followed ligature in one case quoted by Axenfeld.

The following statistics of the results of ligation of the common carotid are published in Tillmann's "Text-Book of Surgery," Vol. ii, Chap. 10.

In 320 cases, 170 recovered and 132 proved fatal, a mortality of about 41 per cent.

Of these 132 cases, 78 were caused by cerebral affections.

In 23 cases, ligation of both common carotids were followed by five deaths,

W. Zimmerman (quoted by Tillmann) in 65 cases quotes a mortality of 31 per cent.; 26 per cent. of these showed brain symptoms.

Pilz and Friedlander (also quoted by Tillmann) give the mortality as 18 per cent. and 13 per cent. respectively.

Conclusion.—(1) That a traumatic sacculated aneurism

of the internal carotid in the cavernous sinus can give rise to the typical symptoms of pulsating exophthalmos.

(2) That this lesion can follow a head injury without being directly caused by basal fracture.

(3) That there is no evidence to prove that this condition does not always occur at first, and a communication with the veins is a later and secondary consequence.

(4) That the signs of pulsating exophthalmos are not necessarily due to the presence of arterial blood in the ophthalmic veins, and need not be dependent on excessive dilatation of these veins.

(5) That in young subjects and in traumatic cases seen early, ligation of the common carotid is the best treatment.

RHINOPHYMA.[1]

BY WILLIAM W. KEEN, M.D.,

OF PHILADELPHIA,

Professor of Surgery in the Jefferson Medical College.

F. W., aged sixty-five years, a tailor, was admitted to the Jefferson Medical College Hospital October 26, 1903. His family history is of no importance, excepting that no case of tuberculosis or of malignant disease is known to him. He himself never suffered from the diseases of childhood, but thirty years ago he had an attack of smallpox. He denies venereal disease. He was discharged from the German army in 1862 owing to the fact that he had convulsions at times. These came on eighteen months after he had enlisted, and were irregular in their occurrence. He has had none for over a year. There is no history of injury to his nose.

Fifteen years ago he had what appears from his description to have corresponded to an attack of acne rosacea, when his face became reddened with a marked eruption of small pustules. His entire face soon became involved, but the brunt of the attack was on his nose and over a considerable adjacent area of each cheek. The face improved, but the nose got worse, and began slowly and gradually to enlarge. It has not interfered with his breathing, but has seriously interfered with his eating. He cannot take any liquid, for example, soup, in a tablespoon without lifting his nose upward out of the way. The nose is painless. It is apt to bleed a little in the morning, owing to his rubbing it in washing his face.

On admission, a very large growth appears to involve all the nose except the upper quarter. The growth is very lobulated, with deep fissures between the lobules, the larger mass being on the right side. It is firm to the touch and, if one may

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judge from the color, would seem to be highly vascular. The alæ of the nose are particularly thickened (Figs. 1 and 2). Urine normal.

Operation, October 28, 1903, under ether. I excised the central portion of the growth from the upper margin of the diseased area down to the tip of the nose by an elliptical incision, the long axis of which corresponded to the bridge of the nose. I then sutured the edges. The pressure of my finger in suturing the lobules of tissue squeezed out from the ducts of the sebaceous glands a number of columns of sebaceous matter, commonly known as " worms." On the alæ of the nose, as it was impossible to obtain a suitable ellipse, I contented myself by simply shaving off all the hypertrophied tissue. The hæmorrhage was not severe; not a single vessel had to be ligated. A few clamps applied for a few minutes and the sutures checked the hæmorrhage almost entirely, and a little adrenalin solution applied on the raw surface where I had shaved it completed the hæmostasis. Between the dressing and skin a bit of gutta-percha tissue was placed so as to prevent adhesion of the dressing to the wound, which would retard the cicatrization.

He made a perfectly smooth recovery from the operation.

On November 4, one week after the operation, a little further paring of the alæ of the nose, so as still further to improve its appearance, was done. On December 12 another operation was done, inasmuch as the second operation left a slight fissure between the ala and the tip of the nose on the left side. The edges of this were pared and approximated by a few sutures. December 17, five days later, these silk sutures were removed. The photographs showing the result of the operation were taken on December 21 (Figs. 3 and 4).

The operation on November 4 was done without any anæsthetic, as it was very slight and he suffered relatively little pain. At the third operation, I infiltrated the nose with a little β-eucaine and adrenalin, but the infiltration was not successful in allaying the pain. At the end of this little operation he had a brief, but marked, general convulsion, during which he seemed to lose consciousness.

Professor Coplin, to whom the specimen was sent, reports that the " histologic examination shows the majority of the sections to be composed mainly of fibrous tissue, a part of the border

FIG. 1.—Appearance before operation.

FIG. 2.—Appearance before operation.

Fig. 4.—Appearance after operation.

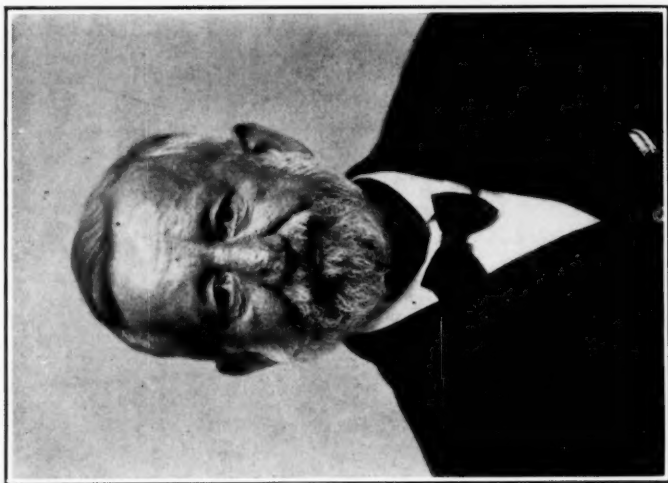Fig. 3.—Appearance after operation. The corrugated condition of the skin is more marked than on the nose itself.

being formed of stratified epithelial cells, such as are found in
normal skin, though the layers of cells are rather fewer in num-
ber than is usually found. The corium and subcutaneous tissues
are directly continuous with, and similar in structure to, the
deeper parts of the sections, which are composed of fairly loose,
cellular, fibrous tissue containing numerous lymph spaces and
blood-vessels. The fibrils of this tissue are exceedingly wavy
and irregularly placed. A very conspicuous feature of the sec-
tions is the sebaceous glands, which are greatly increased in
size and in some areas apparently in number, presenting in the
latter instances an adenomatous appearance. Around some of
the infoldings of the skin are quite dense accumulations of small
mononuclear cells.

" *Diagnosis.*—Soft fibroma of the skin with distention of the
acini, and possibly a hyperplasia of sebaceous glands."

Remarks.—This is one of the most marked cases of acne
rosacea terminating in a true rhinophyma that I have ever seen
personally. In the *Beiträge zur klinische Chirurgie*, Band
xxxix, Heft 1. von Brüns gives some excellent illustrations,
some of them colored in a very lifelike manner, of this condition.
The photographs of the present case show, without, however,
the advantage of color, the condition before operation, and how
successfully the patient was relieved from not only his de-
formity, but of a serious disability so far as his mingling in
social life was concerned, especially at meals, for no one likes
to eat at table with another person when the latter has to lift
his nose out of the soup with each spoonful.

In some of these cases surgeons have been deterred by the
fear of hæmorrhage, which the experience of von Brüns and
the present case show is not well founded. The result of the
operation was all that could be desired, as the photographs
show.

My experience in this case would lead me to suggest that
it is desirable, in case the entire skin is not removed and the
edges sutured, but the skin shaved off, that this shaving should
not go entirely through the skin. In only one place towards the
tip of the nose on the left side did I shave away the entire thick-

ness of the skin.   At this point there is distinct scar tissue.   In
other parts of the nose, where I only shaved one-half or two-
thirds through the thickness of the skin, there is a cutaneous
surface which, though not entirely normal, is much better than
the scar tissue.

SIALOLITHIASIS.[1]

BY O. THEODORE ROBERG, M.D.,

OF CHICAGO, ILLINOIS,

Surgeon to the Swedish Covenant Hospital.

SIALOLITHIASIS is of relatively infrequent occurrence. In 1896, Fütterer [1] was able to collect 160 cases. I have collected forty-seven cases occurring since that time.

The following case was seen by the writer in November, 1902:

Mr. M., aged fifty-eight years, came to me complaining of a large, diffuse, and painful swelling, involving the right side of the neck and lower part of face.

In 1874, for the first time, the patient noticed that a lump appeared in the right submaxillary region when he ate something sour or saw something which caused his mouth to water. The swelling usually attained the size of a walnut, and would remain for from thirty minutes to two hours, disappearing gradually. This occurred from once a week to once or twice a year until 1893, when the swelling appeared and remained for six weeks. Before this there had been very little pain. At this time the floor of the mouth became swollen, reaching to the cutting edge of the lower teeth, and the patient began to have much pain, which was referred to the right side of the lower jaw. Two teeth were extracted, but without relief. There was a good deal of pain and difficulty connected with swallowing, but none with chewing or speaking. He noticed a small amount of pus discharging from under the right side of the tongue, and was told by some physicians that he had a cancer. Dr. Fenger, who was then consulted, removed a pea-sized stone from Wharton's duct, and five days later sutured the opening made into the duct. It is probable that the stone had existed for nineteen years.

After this the patient remained well until August, 1901

(eight years), when a hard and painful swelling, the size of a hickory-nut, again appeared in the right submaxillary region. During the next six months it increased gradually in size, after which the entire side of the neck began to swell and became painful. In February, 1902, he consulted a doctor, who incised the swelling, giving exit to a large amount of pus. After two weeks the incision had closed. After this, however, the swelling did not disappear entirely, and during the next eight months there were periods during which the swelling became larger and painful, subsiding again in a few days. In October, 1902, the swelling became quite large and very painful. For several weeks following this there was an occasional discharge into the mouth of a sweetish taste. There was a sense of fulness in the mouth, some pain on swallowing, and difficulty in opening the mouth.

Previous History.—He has never been sick in bed. Formerly, he smoked and chewed tobacco excessively, keeping the tobacco in the *right* side of the mouth. His saliva used to flow very freely when he used tobacco. His teeth were in good condition until 1885, when he began to suffer with Rigg's disease. Since that time there has been excessive tartar formation on the teeth. There is no history of infection of the salivary glands, of the mouth, or of tonsillitis.

Family history negative.

On examination, November 25, 1902, the right side of the neck and face was swollen, the swelling reaching as high as the malar bone, and as low down as the clavicle, and it was most prominent in the submaxillary region. The skin over this area was dark red in color and œdematous. On palpation it was somewhat painful. In consistency it was of board-like hardness. There were no areas of softening, nor could any fluctuation be detected. Inspection of the mouth showed no swelling or discoloration of the mucous membrane. There was recession of the gums with considerable tartar formation on the teeth. Digital examination of the floor of the mouth revealed a hard nodule, the size of a large pea, on the right side, opposite the position of the second molar tooth. It was immovable, and felt as if it were attached to the inner surface of the lower maxilla. A needle introduced into the nodule gave exit to a small amount of pus and apparently did not strike any hard body, and the nodule did not diminish in size after the escape of pus. A No.

2 Bowman probe was passed into Wharton's duct as far as the nodule. There was no sensation of contact with a hard body. The left side of the neck was normal and no glands could be felt on either side. Temperature 99° to 100° F. Urine examination, negative.

A diagnosis was made of calculus in Wharton's duct, and probably in the submaxillary gland, with suppuration of the gland and suppurative cellulitis of the neck.

November 26, 1902. I made an incision, under local anæsthesia, into the mass, and a small amount of thick, curdy pus escaped. One week later the swelling was considerably smaller, and pus had ceased to discharge. The patient was then anæsthetized. The nodule in the mouth was incised, and by means of a small curette a concretion the size of a split pea was removed. An incision about three inches long was then made externally, parallel with the lower border of the jaw, and one-half inch below it. By means of blunt dissection through a mass of dense scar tissue the submaxillary gland was exposed and removed. The wound was packed with iodoform gauze, and only partly closed. A second calculus was found lodged in the beginning of the duct.

Five weeks after the operation the wound was completely closed. After the operation there was paresis of the angle of the mouth, from which the patient had completely recovered four months later.

In order to determine whether there was anything in the patient's saliva that would throw light on the etiology of concretions, I collected his saliva and determined the total solids, inorganic solids, and reaction, with the following results:

Total solids, .86 per cent.

Inorganic solids, .28 per cent.

Alkalinity to litmus, first specimen, 5 cubic centimetres saliva required 4 cubic centimetres, n/100 oxalic acid.

Second specimen, 5 cubic centimetres saliva required 7.5 cubic centimetres, n/100 oxalic acid.

Acidity to phenolphthalein, first specimen, 5 cubic centimetres saliva required 2.9 cubic centimetres, n/100 potassium hydroxide.

Second specimen, 5 cubic centimetres saliva required 1.3 cubic centimetres, n/100 potassium hydroxide.

In determinations of normal saliva by Chittenden and Richards,[2] the total solids varied from .32 per cent. to 1.02 per cent., and the inorganic from .15 to .28 per cent.

The reactions as given above also correspond with most analyses. Therefore, in regard to solids and reaction, the saliva is normal.

Description of the Concretions.—The larger concretion is spherical in shape, and measures 6 to 7 millimetres in diameter. It weighs .2 gramme. The smaller is somewhat pyramidal in shape and measures 3 to 4 millimetres in diameter. They are light grayish brown in color. The surface has a cauliflower appearance, except where the stones had been in contact with each other, where there is a facet on each stone. Section of the larger stone shows it to be made up of three parts,—the central a nucleus, a round, hard body which lies in a cavity somewhat larger than the nucleus; next to this cavity are several lamellæ, which can easily be separated from one another; the outer layer is more compact and darker in color. The smaller stone on section is seen to be made up of two parts,—the central soft and spongy, the outer harder and more compact. (See illustrations.)

The gland measures 3.7 centimetres by 2.5 centimetres by 2 centimetres and weighs 8.5 grammes. The mesial surface is quite smooth and free from adhesions, and the external surface is covered with fibrous tissue. It is of cartilaginous hardness, and the cut surface is smooth and glistening. There are numerous pinhead-sized points, which are of a more grayish color, and lack the glistening appearance of the greater part of the gland. Pressure upon the gland causes a thick, yellowish-white fluid to exude from these points. Smears of this fluid show polymorphonuclear leucocytes, degenerated epithelial cells, and an occasional diplococcus. Means were not at hand to make cultures.

Histologic Examination. (By Dr. P. Bassoe.)—" About two-thirds of the sectional area are found to be occupied by a dense old fibrous tissue. Between its bundles, and particularly around the vessels, both large and small, are collections of round cells, most of which possess the morphologic characteristics of plasma cells. Some vessels, however, are not surrounded by such cells. The endothelium of the smaller vessels has participated in the inflammatory proliferation. There are no acini remaining in the section, but many glandular ducts are present and in-

FIG. 1.—Interior of larger calculus, magnified six diameters.

FIG. 2.—Interior of smaller calculus, magnified six diameters.
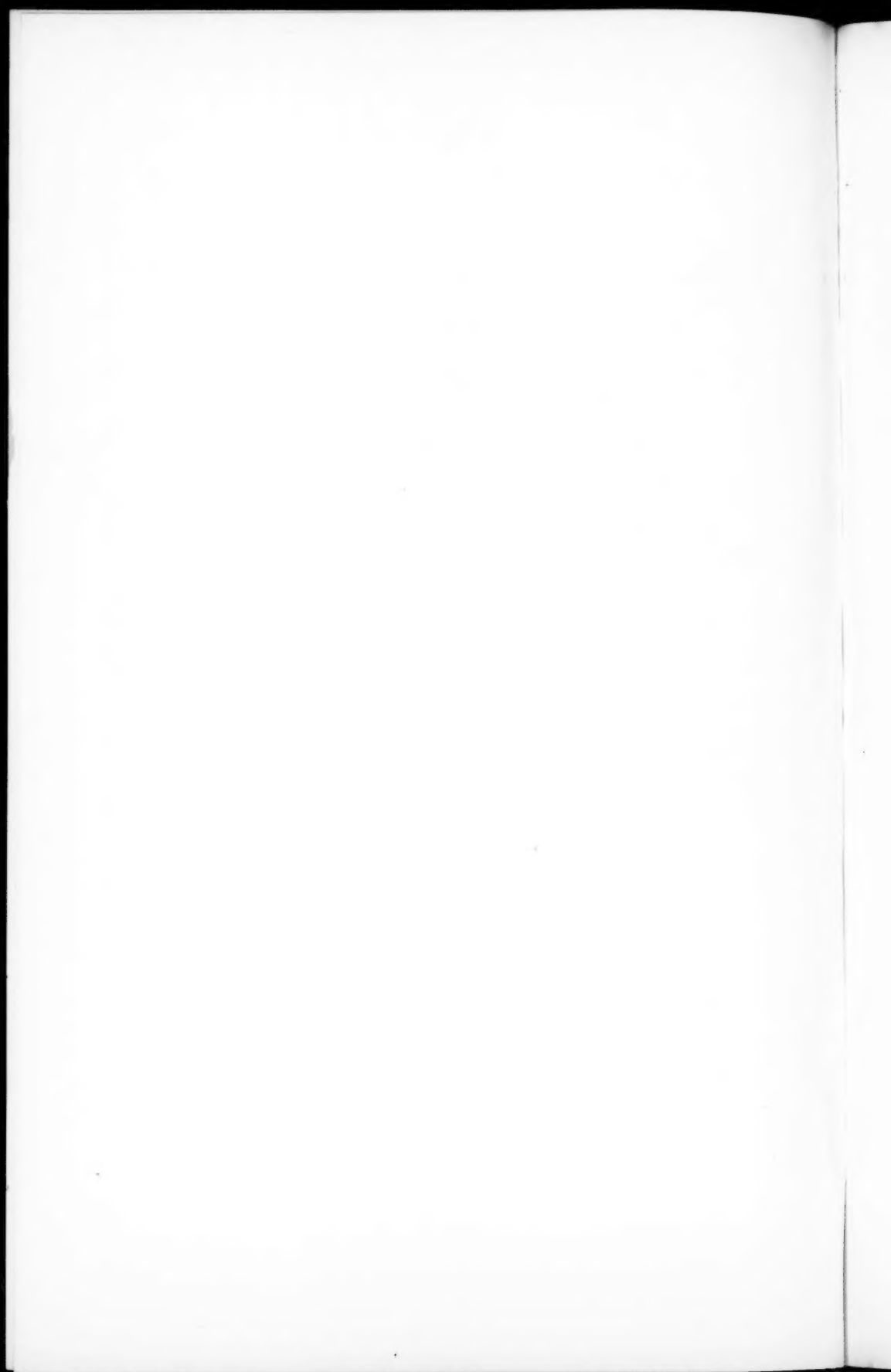
variably surrounded by large collections of round cells. Their
epithelial lining is proliferating, and the lumina contain degen-
erated epithelial cells and a few polymorphonuclear leucocytes.
The latter cell is also seen here and there outside the ducts. In
sections stained for bacteria by the Gram-Weigert method, short
bacilli are found in small number. They are short, rather thick,
generally occur in pairs, and are deeply stained.

" I also examined a slide from another portion of the gland.
This contains a larger amount of gland tissue, otherwise it answers
to the description given above."

Calculi occur most often between the ages of twenty years
and forty years. Burdel [3] reports the occurrence of a calculus
in the sublingual duct of a child aged three weeks. There had
been difficulty in nursing, and it is reasonable to conclude that
it had existed at the time of birth. Men are more often affected
than women. Czygan [4] gives the proportion of two to one.
Another writer gives five to one. (Duparque and Melian.[4])

Calculi vary in size from that of a grain of sand to one
measuring one and one-eighth inch in length and two inches in
circumference.[5] The usual size is from that of a split pea to
that of a date-stone or hazel-nut. They occur most often singly.
In the forty-seven cases collected by the writer there was more
than one calculus in seven cases. A large number of small con-
cretions may be discharged from the duct, as in Spencer's [6] case,
in which also the submaxillary gland was filled with miliary
calculi. Recurrence takes place in a small percentage of cases.
Of these forty-seven cases, there were five with recurrence;
one had [7] three recurrences in twenty-two years; one, two re-
currences, and two, one recurrence.

In shape, the calculi are usually spherical or oval; in the
ducts they often become elongated and resemble date-stones.
When multiple in the duct they are arranged end to end, and
the opposed surfaces are faceted. The surface is finely or
coarsely granular and the color is a dirty yellowish gray.
Usually the structure and composition are homogeneous. To
this there are numerous exceptions, as in the writer's case and
others.

22

O. THEODORE ROBERG.

Potties [8] reports a case in which the calculus was made up of two parts,—the central consisting of uric acid and a small amount of calcium phosphate and calcium carbonate, the outer part being made up of calcium phosphate and calcium carbonate, about 69 per cent. of the former and 20.1 per cent. of the latter. Galippe has also described concretions which had a laminated structure. In a few cases foreign bodies have been found as nuclei. Calculi are made up mostly of calcium phosphate and calcium carbonate. Some contain ammonio-magnesium phosphate. The following analyses are taken from v. Gorup Besanez.[9]

	I.	II.
Calcium carbonate	81.3	2
Calcium phosphate	4.1	75
Soluble salts	6.2	
Organic matter	7.1	23
Water, etc.	1.3	

The following table shows the relative frequency of the occurrence of calculi in the various glands and ducts:

	In Wharton's Duct.	In Submaxillary Gland.	In Stenson's Duct.
Czygan	22	4	4
Writer's	28	14	2

	In Parotid Gland.	In Sublingual Duct. D. Rivine.	D. Barth.	In Sublingual Gland.
Czygan	1	5	1	0
Writer's	1	0	0	2

Etiology.—The cause of calculus formation in the salivary glands or ducts has been the subject of much discussion. In some of the early reported cases foreign bodies were found within the calculi. Naturally, it was concluded that these were the cause of their formation. The foreign bodies found were pieces of fish-bone, wood, bristle, and a shot. Foreign bodies have been found in only a small percentage of cases. In one case a cavity was found corresponding to a mustard seed, which it was thought had found its way into the duct. This is important, as it indicates that a foreign body can be the cause of a calculus and become disintegrated and disappear. In this con-

nection, it is important to note the occurrence of foreign bodies in the ducts without giving rise to the formation of calculi. Cabot [10] reports a case in which a piece of straw had been lodged in Wharton's duct for six months. In another case [11] there was a piece of hair in Stenson's duct for two months. Cosens [12] reports two cases in which particles of grass had been lodged in the submaxillary duct and sublingual duct,—in the former for eighteen months, and in the latter for four months. In all these cases suppuration took place without the production of calculi. Foreign bodies are found in the ducts more frequently without the production of calculi.

Galippe [13] has made cultures from the interior of the calculi, and has found bacteria in all cases. He concludes, therefore, that bacteria constitute the essential etiological factor. Hartman [14] has likewise found bacteria in smears and cultures. It appears reasonable that bacteria should be a *sine qua non*. But if infection alone were the principal factor, why do not calculi occur more frequently, and why do they not occur most frequently in the gland and duct which are most often the seat of infection, namely, the parotid and its duct?

If bacteria give rise to the formation of the calculi, how do they do so? It is ordinarily stated that saliva undergoes acid fermentation. This is probably true in the presence of carbohydrates, which may be found in the mouth; but we do not expect this to take place in the ducts or glands. I have made a number of experiments, with a view of determining whether the tendency of the saliva is towards acid or alkaline fermentation. With the proper precautions, I have collected saliva into a sterile bottle and determined the degree of alkalinity to litmus and degree of acidity to phenolphthalein. Saliva is usually alkaline to litmus and acid to phenolphthalein, which shows, of course, that the reaction is due to the presence of the hydrogen phosphates and carbonates. In some cases the saliva was allowed to stand at room temperature, and in others it was placed in an incubator for from one to several days. Invariably the degree of alkalinity was increased and the acidity decreased.

Results of determinations in two specimens.

Specimen 1. Fresh. Five cubic centimetres saliva required 4 cubic centimetres n/100 oxalic acid, and 2.9 cubic centimetres n/100 potassium hydroxide.

Same specimen, twenty-four hours later, room temperature, 5 cubic centimetres required 5 cubic centimetres n/100 oxalic acid, and 1.1 cubic centimetres n/100 potassium hydroxide.

Same specimen, seven days old. Five cubic centimetres required 6.2 cubic centimetres n/100 oxalic acid. (Quantity of saliva insufficient to determine acidity.)

Same specimen, nine days old. Five cubic centimetres required 12.5 cubic centimetres n/100 oxalic acid. (Quantity of saliva insufficient to determine acidity.)

Specimen 2. Fresh. Five cubic centimetres required 7.5 cubic centimetres n/100 oxalic acid. 1.3 n/100 potassium hydroxide.

Same specimen, twenty-four hours in incubator. Five cubic centimetres required 9 cubic centimetres n/100 oxalic acid. (Quantity of saliva insufficient to determine acidity.)

This is important, because the calcium phosphate and calcium carbonate, of which the calculi are made up, are rendered insoluble by the increase in the degree of alkalinity. It requires very little change in the composition of saliva to cause a precipitation of the calcium salts. If saliva is exposed to the air for a short time, CO_2 escapes, and a thin film forms on the surface, which on examination is found to be calcium carbonate. Hence the removal of CO_2 alone is sufficient to precipitate the calcium salts. When the bacteria decompose the proteids in the saliva, ammonia is produced, which probably immediately unites with the CO_2 held in solution, and we promptly have the conditions favorable for calculus formation. From this it is reasonable to conclude that the bacteria cause a precipitation of the calcium salts of the saliva by increasing the alkalinity of the saliva and removing the CO_2, as explained above. But this does not explain why calculi are found so much more frequently in the submaxillary gland and its duct than in the others.

Obstruction to the outflow of saliva, retention and consequent thickening of the saliva, have been given to explain the formation of salivary calculi. Salivary cysts are less frequent than salivary calculi; in fact, they are quite rare. In the cases of salivary cysts which I have found reported, in only one was there a deposition of the insoluble salts, and that was

in a parotid duct cyst.[15]   Salivary cysts of Wharton's duct are the least frequent, while, as we have seen, calculi occur there most often.

Loveland [16] reports a case of occlusion of Stenson's ducts in a middle-aged woman, which probably dated back to an attack of diphtheria at the age of thirteen years.   Here was a case of retention of saliva for years without any concretions forming.

Skirving [17] reports a case of shorter duration, with thickened and viscid saliva, without any concretions.   It is improbable that salivary cysts are an important etiological factor.

We naturally ask, Why do calculi occur so much more frequently in the submaxillary gland and its duct?   We must explain this fact by either the anatomical conditions of the duct or the composition of the submaxillary saliva, as differing from that of the other glands.   As factors predisposing to a precipitation of the calcium salts, we will mention a high percentage of solids, high percentage of organic matter, greater degree of alkalinity, and a low content of CO_2.   The sublingual saliva contains more total solids, more organic matter, more mucin, and has a higher degree of alkalinity than the saliva of the parotid and submaxillary glands.   The amount of CO_2 is about the same in all the salivas.   Therefore, if the composition of the saliva should determine where the concretions would most likely occur, they would occur in the sublingual gland and its duct.   As a matter of fact, the occurrence of a stone in the sublingual gland and its duct is rare.   We must therefore look to the anatomical conditions for an explanation of the greater frequency of occurrence of calculi in the submaxillary gland and its duct.   If we exclude stasis of the saliva as an important cause of calculus formation, the length of duct and direction of duct, whether upward or downward, are of little significance.

In what way could the anatomical conditions favor the production of calculi?   It is admitted that bacteria are an essential etiological factor.   We have stated that the parotid gland is the one most often the seat of infection.   Inflammation of the ducts

also occurs in the absence of infection of the glands. According to Küttner,[18] inflammation of Stenson's duct is most frequent. If we admit the bacterial origin, alone, of the calculi, the anatomy of Wharton's duct does not explain why the greater proportion of calculi are found there. Foreign bodies are found in Wharton's duct more often than in the others. Of seven cases of foreign bodies in the ducts which I have found reported, four were found in Wharton's duct, two in Stenson's duct, and one in the sublingual duct.

From the foregoing, it appears that something in addition to bacteria is necessary to explain the production of calculi. To me that something appears to be a foreign body. Foreign bodies, particles of tartar and food can enter Wharton's duct more readily than the others, because of the greater size and the location of the orifice. The composition of tartar is very similar to that of the calculi. Therefore, although tartar might often be a determining factor, we would be unable to demonstrate it. Food particles might easily undergo decomposition and simply add to the percentage of organic matter in the calculus. The question arises whether a constitutional condition can in any way predispose to calculus formation. If a general cause were at all active, we would expect it to exert an influence upon more than one gland in a given case, and give rise to calculi in the several glands or ducts. In only one case[19] have calculi been found in more than one gland or duct in the same person. It appears probable that an increase in the total solids of the saliva may be a predisposing factor. Langley and Fletcher[20] have shown that the salts of saliva increase directly with the rate of secretion.

Ballard[21] reports a case in which calculi were discharged five years after the patient was salivated during an attack of jaundice. In the writer's case there is a history of excessive flow of saliva caused by the use of tobacco.

The symptoms of salivary calculus are determined by the size of the calculus, its location, and the occurrence of suppuration. In the absence of suppuration, a calculus may exist for years without much disturbance. There are cases on record in

which calculi have existed for fourteen, twenty-eight, and even forty years.[22] [23] [24] [25]   The most characteristic symptom of calculus in Wharton's duct, and usually the earliest, is the so-called " salivary colic" of the French, characterized by intermittent retention of saliva, and accompanied by more or less pain and discomfort. This retention of saliva, with the formation of a swelling in the floor of the mouth and in the submaxillary region, usually comes on when eating, and remains for one or several hours, disappearing gradually. Or it may be made to disappear by pressing upon it, expressing the retained saliva into the mouth. This swelling may come and go for years, as in the writer's case, until suppuration occurs, when the swelling becomes more or less permanent. The retention is not determined entirely by the size of the calculus. Weber [26] reports a case in which a concretion the size of a mustard seed caused retention, while there are some cases with a calculus the size of a cherry-stone or date-stone, in which there have been no symptoms of retention.

The patient may be aware of the presence of a hard nodule in the mouth.   There is usually some difficulty in chewing, swallowing, and speaking; at times, chewing and swallowing may be almost impossible. It may be difficult to open the mouth. The swelling in the floor of the mouth may reach the cutting edge of the teeth. Freudenthal [27] reports a case in which the abscess became so large that death resulted from asphyxiation. The abscess frequently bursts into the mouth, often discharging the calculus also. If only one calculus has been present, a cure results. Sometimes the stone causes a pressure necrosis of the overlying tissues, escaping through the opening thus made. In rare cases [7] the calculus may be discharged through the normal orifice of the duct. Winslow [28] reports a case in which he found a calculus in a swelling directly over the larynx. Several months before, the patient had noticed a swelling underneath the tongue, which had disappeared spontaneously. With suppuration in the duct, there is usually infection also of the gland, giving rise to a painful swelling of the submaxillary gland.

When the calculus occurs in the submaxillary gland, the gland enlarges and becomes firm in consistency and tender to palpation. The gland may remain slightly enlarged and tender to the touch for years; it increases slowly in size, and usually becomes more painful. There are periods when the gland swells acutely and becomes very painful, to subside again to its former condition. Eventually a suppurative cellulitis of the neck may supervene, and a diffuse phlegmon involving the greater part of the side of the neck and face develops, resembling a case of Ludwig's angina. Even this may subside, as happened in the writer's case, to return at a later date. If not opened, it may burst spontaneously. In some cases a fistula results, discharging pus and concretions.[29]

In twenty-seven cases of fistula of Stenson's duct discharging saliva, as given by Duplay and Reclus,[30] three were caused by calculi. I have not found a salivary fistula of the other ducts or glands caused by calculi.

The constitutional effects of salivary calculi are usually slight.

Diagnosis.—A diagnosis of salivary calculus is easily made when there is a history of " salivary colic," followed by an inflammatory swelling in the floor of the mouth. The calculus can often be detected by sounding the duct. Retention of saliva and suppuration can be caused by foreign bodies in the ducts, or by an inflammation of the duct in the absence of any foreign body. An abscess in the floor of the mouth, in the absence of a history of retention of saliva, may suggest an alveolar abscess. The abscess which develops about the submaxillary gland is very easily mistaken for an alveolar abscess if a good history is not obtained. When the calculus occurs in the gland, it may be difficult to arrive at the correct diagnosis. A gradual enlargement, with periods of acute inflammatory symptoms, suggests a calculus. Syphilis, tuberculosis, actinomycosis, malignant disease, and the " inflammatory swelling" of Küttner[31] must be considered. A large percentage of the cases are diagnosed malignant disease.

In a case reported by Gerota,[32] a calculus in the submaxillary gland was detected by the X-ray.

Treatment.—The indications are to evacuate the abscess, remove the calculus, and in some cases to extirpate the gland. When a stone is located in the duct, it should be removed through the mouth. This can usually be done with local anæsthesia. However, at times bleeding is very free, and the stone is so difficult of removal that a general anæsthetic becomes necessary. In some cases the granular surface of the calculus is very firmly adherent to the surrounding tissues, making its removal somewhat difficult. The removal of stones in Stenson's duct through the mouth may be impossible. Solé [33] removed six calculi from Stenson's duct from the outside, suturing the duct, and obtained healing by primary intention, without any salivary fistula. Fenger was in the habit of suturing the opening made into Wharton's duct, although made from inside the mouth. If a gland has been the seat of infection secondary to a calculus in the duct, even for a long time, the enlarged gland becomes normal in size in from one to two weeks after the removal of the calculus.[19]

If the submaxillary or sublingual gland is thought to be the seat of a calculus, it must be reached from the outside. After exposure of the gland, it is incised. If a single calculus is found and the gland not much changed, the calculus can be removed and the gland left. If the calculi are multiple and difficult to remove, or the gland is the seat of miliary abscesses, it is well to extirpate the gland.

In case of calculus of the parotid gland, incision, removal of the calculus and drainage are, of course, all that could be done.

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STRICTURE OF THE ŒSOPHAGUS DUE TO TYPHOID ULCERATION.

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THE literature of stricture of the œsophagus following an attack of typhoid fever is meagre enough to justify recording three that have fallen under my notice since the year 1896.

CASE I.—O. G., aged seventeen years; male; white. The patient came under my observation in the spring of 1896 suffering from a tight stricture of the œsophagus. In the fourth week of typhoid fever he complained of difficulty in swallowing. As stated by his family physician, the fever was of a severe type, but not prolonged beyond the sixth week, and free from all serious complications. There was nothing in the manner of treatment that deserves comment.

The difficulty in swallowing became more evident as convalescence progressed, and in a few weeks he was unable to swallow anything but liquids.

Nine months after the subsidence of the fever he came under my care, at which time the stricture was so tight that he took about half an hour to swallow a glass of water. He was not greatly emaciated, owing perhaps to the fact that he had accustomed himself to swallowing milk the whole day long.

I attempted to pass a bougie (the smallest in my œsophageal set), but was unable to pass a stricture near the cardiac orifice of the stomach. After much trouble, I succeeded in passing a long probe with an olive-shaped end about four millimetres in diameter.

I then had a set of olives made, which could be screwed on to a flexible metal rod. The diameters of the olives increased in size by one millimetre up to ten millimetres; above this the sizes increased by two millimetres. In about four weeks I succeeded in passing one fourteen millimetres in diameter. The patient

683

then returned home with a set of bougies of the ordinary kind, and with instructions to have them passed regularly.

Soon after his return (before any bougies had been passed), he complained of feeling sick, and of soreness at the site of stricture. He then suffered from fever, and began to swallow with difficulty. Then he began to cough and vomit quite a quantity of mucus.

Swallowing became more and more difficult and nausea distressing, and the patient became weaker, and gradually sank three months after his return. No bougie was passed after he left my care.

CASE II.—F. P., aged twenty-six years; male; white. The patient suffered from a severe attack of typhoid fever, and at the end of the fourth week noticed a difficulty in swallowing capsules. At the end of the sixth week he noticed a difficulty in swallowing solid food. Soon he was unable to swallow any solids, and in a short time fluids began to pass with difficulty, causing hiccough and regurgitation. Swallowing became progressively worse, until in October, 1902, ten months after the first onset of the fever, he found himself unable to swallow a drop of water.

He then came under my care, and for three days had been unable to swallow a drop of water.

On examination, I found a very tight stricture near the cardiac orifice of the stomach, fifteen and one-quarter inches from the upper incisors. This I succeeded in passing by using a bougie four millimetres in diameter. Treatment by gradual dilatation was instituted, and by December 20 I managed to pass one twelve millimetres in diameter. Dilatation was very slow, because treatment had to be stopped for days on account of soreness at the point of stricture. A break in treatment occurred between December 20 and February 15. The stricture contracted to its former lumen, and treatment had to be started from the beginning. This time the dilatation was more rapid, and by the end of March I had succeeded in passing a bougie fifteen millimetres in diameter. The patient then left for home, provided with a set of bougies. I last heard from him in October, when he stated that he was getting along very nicely.

CASE III.—J. W. B., aged twenty-six years; male; white. The patient had suffered from a very severe attack of typhoid fever which lasted seventy-two days. At the end of the first

month he noticed a difficulty in swallowing a capsule, which he
said lodged in his gullet near the lower end.

Liquids passed with ease. After 100 days he was allowed to
eat solid food, but found himself unable to swallow it. It would
pass as far as the lower end of the gullet, and occasionally stay
there for several hours before it was regurgitated. The difficulty
in swallowing became more marked, until in February, 1903 (four
and a half months since the onset of the fever), he came to con-
sult me.

At this time he could swallow liquids only. On the whole
he swallowed fairly well, taking about three minutes to swallow
a glass of water. On passing a bougie, it was arrested at a point
eight inches from the upper incisors. A smaller bougie was passed
through this obstruction, and was arrested at a point thirteen
and one-half inches from the upper incisors. Thence it passed
smoothly into the stomach.

Treatment was continued on the same lines as in the other
cases. The strictures were easily dilated, and in thirty days we
had succeeded in passing a bougie sixteen millimetres in diameter.
The patient then went home, but in three weeks returned with
symptoms of closure. The strictures were easily dilated, and he
again returned home with a complete set of bougies.

The histories of these cases is all the evidence that I have to
present to prove that these patients suffered from typhoid fever.
This with the statements of the family physicians must be ac-
cepted as final.

As to the frequency of ulceration of the œsophagus during
the course of typhoid fever, opinions differ greatly.

Louis[1] mentions œsophageal lesions as of comparatively
frequent occurrence. Out of forty-six autopsies, he found
lesions present in the œsophagus in seven cases.

Hölcher[2] found only one instance of an œsophageal lesion,
viz., gangrene in 2000 autopsies.

Berg[3] in 1628 autopsies found no lesions; and Dopfer[4]
none in 927 cases. Louis's description of the ulcers, which has
now become classical, is as follows: " When few in number, the
ulcers are confined to the region near the cardia or in the middle

part of the tube; or at least to within an inch or two from the bottom of the pharynx. Even under these circumstances, the ulcers were more numerous and larger near the cardia than elsewhere. They were oval in shape and directed vertically, the long diameter varying from two to twelve lines. Most of them were superficial, but some of them were deep, exposing the muscular coat. They had never gone on to perforation. They were not found in patients who died after at least sixteen days of the disease; and not at all in those who died between the eighth and fifteenth days (from Mitchell).[5]

This frequency compares curiously with the most recent reports. Thus, Ouskow [6] in 439 autopsies, representing 6513 cases, found no definite œsophageal involvement in a single case. In the majority of the cases the pharynx was reddened, and in parts deprived of its epithelium and covered with membrane. In some cases the tonsils were so inflamed as to suggest diphtheria. Laryngeal ulceration was quite common, being present in 30 per cent. of the autopsies.

Mitchell [5] reports one case of œsophageal ulceration occurring in Professor Osler's service at The Johns Hopkins Hospital. The histological description of this ulcer, which is most carefully described, was of a typhoid type, but no evidence could be found of the typhoid bacillus. The following is an abstract of the clinical features: The patient died on the eighteenth day of the disease. At the autopsy, the œsophagus showed three definite ulcers situated at its upper part. All three were nearer the posterior than the anterior surface. The two larger ones lay one on each side in the depression between the lateral walls of the œsophagus and the thyroid cartilage. The larger of these was on the left side, three centimetres from the commencement of the gullet. It was placed obliquely, and measured one centimetre in length by two and one-half centimetres in width. Its edges were sharply cut, and at its base the muscle was exposed. The base was clean. The other ulcer was almost opposite, circular in form, three millimetres in diameter, with a hæmorrhagic base reaching into the submucosa.

Riesmann [7] reports another autopsy. He found on the

upper part of the œsophagus, on the anterior wall to the right of
the middle line, a chain of four ulcers extending perpendicularly
downward from a point three and one-half centimetres from
the base of the pharynx. (Unfortunately, no examination of
the ulcers is reported.)

As to the exact nature of these ulcers met with during the
course of typhoid fever, nothing definite can be said.

Louis did not consider them as due to typhoid infection, but
rather as a complication due to the extreme malnutrition of the
tissues. It is very probable that the ulcers found at the lower
end of the œsophagus are due to peptic digestion of the œsopha-
geal mucosa. In many exhausting diseases, where the patient
has lain for a long time before death in an extremely weak state,
ulcerative lesions of the œsophagus have been observed. Thus,
Eversman [8] reports numerous peptic ulcers above the cardiac
orifice of the stomach, and also perforation of the œsophagus.
But this theory will not satisfy us in the case of ulcer in the
upper portion of the gullet. Here it is quite probable that some
of them are of typhoid origin. The case described by Mitchell
certainly belongs to this class histologically.

The symptoms recorded in the cases met with clinically
have been few. *Dysphagia* has been the commonest. In most
of the cases this has been the only symptom. In the three cases
reported by me it occurred about the end of the fourth week, and
was brought to notice by the inability of the patient to swallow
capsules. As a rule, in the cases reported, the stricture was
revealed when the patients were allowed to take solid food.
Hæmatemesis has been noticed in one case only (Packard's).
It is a fairly common event in many cases of typhoid fever;
but in some of the cases in which this symptom was present the
autopsies showed no œsophageal lesions; therefore we have no
right to assume, even in Packard's case, that the hæmorrhage
was from the œsophagus.

There is no reason to think, in any of the reported cases,
that the drugs given during the course of the fever had any part
in the causation of the cicatrix.

I have made a careful review of the literature, and find

that nine cases of stricture have been described, to which I personally add three more, making twelve in all. It is remarkable that, with one exception (Mitchell's case), all occurred in males.

The following is a brief *résumé* of the cases:

Packard's Case.—Male; aged thirty-five years; white. A very severe attack of fever, during the latter part of which he suffered from hæmorrhages from the mouth and bowels. Two strictures were present, one twenty-**five** centimetres, the other thirty-one centimetres, from the incisors. Both were very tight. At last a bougie 2.5 millimetres in diameter was passed, after which the stricture was gradually dilated. The patient did not progress as favorably as could be wished, and was eventually operated upon in New York by Dr. Dennis, a gastrostomy being performed.

Summers's Case.—Severe attack of typhoid fever which lasted for twelve weeks. The stricture was found thirty centimetres from the teeth. A filiform whalebone bougie was passed. A gastrostomy followed by Abbe's retrograde dilatation by the string method was the treatment adopted. A bougie was afterwards passed from time to time. The patient progressed very well.

Tinker's Case.—Male; aged thirty-one years. A very severe attack of severe case. The original attack lasted three weeks. Then came a relapse with delirium and vomiting. At the end of the sixth week she became conscious and complained of difficulty of swallowing. The stricture was situated thirty-four centimetres from the teeth. It admitted an olive-pointed bougie three millimetres in diameter. It was gradually dilated by means of olive-pointed bougies.

Tinker's Case.—Male; aged thirty-one years. A very severe attack of typhoid fever. Was in bed five months. At the end of three months he noticed the first symptoms of dysphagia. The site of stricture was twenty-nine centimetres from the teeth. At the time of observation gastrotomy and retrograde dilatation had been done by another surgeon. Case never presented himself for further treatment.

Dugan's Cases.—CASE I. Male; aged eighteen years. Convalescent in eight weeks. In the sixth week he complained of pain in his stomach. He died from want of treatment. Before death he could swallow nothing at all.

CASE II. Male; aged (?). Convalescent at the end of eight weeks, then a relapse. Convalescent again six or seven weeks after this. The site of the stricture was fifteen inches from the upper incisors. Attempts to pass bougies were of no avail. Operation. Gastrostomy, with no attempt at dilatation.

Pyle's Case.—Male; aged (?). Prolonged attack of typhoid fever lasting from ten to eleven weeks. Pain and dysphagia during the attack. Situation of the stricture was near the cardiac orifice. A bougie one-sixteenth of an inch in diameter was passed, and then the stricture was dilated by an ingenious system of rubber bags distended with water.

Roberts's Cases.—Two cases. Both were young men and both had a very long seizure of fever. The evidence of stricture was present when solid food was first taken. Stricture in both cases was near the cardiac orifice of the stomach. Operation was advised and in both cases refused. Both patients died shortly afterwards of starvation.

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[5] Mitchell.   Johns Hopkins Hospital Reports, Vol. viii, p. 295.

[6] Ouskow.   Archives des sciences biologiques, Tome ii, No. 1, 1893.

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ONE HUNDRED CASES OF GASTRO-ENTEROSTOMY FOR SIMPLE ULCER OF THE STOMACH AND DUODENUM.[1]

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OF LEEDS.

DURING the last few years I have operated upon over 160 patients for diseases of the stomach and duodenum. The cases include examples of malignant disease treated by gastrectomy, partial or complete, or by gastro-enterostomy; of hour-glass stomach; of perforation of ulcers; and of chronic ulcers of the stomach which were in need of surgical treatment for one reason or another.

Up to October 1, 1903, I had performed gastro-enterostomy for ulcer of the stomach or of the duodenum exactly 100 times. In the following paper I have attempted an analysis of this series of cases.

It will be readily admitted that all the records in a long series of such cases are not of equal value. The experience which ripens with each successive case is not at the bidding of an operator at the beginning of his career. The earlier records are, therefore, imperfect; many observations which would now be made were then omitted, as the need for them was not appreciated.

The total number of operations was 100, the mortality two. Eighty-five cases were operated upon for chronic ulcer with intractable dyspepsia, or dilated stomach, with one death. Fifteen cases were operated upon for profuse and recurring hæmorrhage, with one death.

There were fifty-six females and forty-four males. The youngest patient, a female, was aged seventeen; the oldest, a male and a female, were each sixty-two. The average age was thirty-five.

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[1] Read before the Clinical Society of London, December 11, 1903.

In ten cases the induration around a chronic ulcer was so marked that I have recorded the presence of a " tumor."

In two cases, both females, the patients said they had suffered from stomach troubles " all their lives," and that vomiting was present in early infancy. In the first there was pyloric thickening with complex adhesions, in the second I have noted that the pylorus was like a " thick and rigid tube;" in this case there were no adhesions. It is possible that in both a congenital malformation of the pylorus was present.

In fifty-eight cases the presence of a single ulcer or of the scar of a single ulcer was noted. In twenty cases there were two ulcers, in four cases there were three ulcers, and in seven the ulcers are described as being multiple. This statement needs criticising, for I found, as my experience grew, that, on more careful and more extended examination of the stomach on both anterior and posterior surfaces, a second or a third ulcer was frequently found that formerly would have been overlooked. In the earlier cases, five in number, when the anterior operation of Wölfler was performed, the posterior surface of the stomach was not examined. In the last fifty operations more ulcers than one were found in the stomach on twenty-two occasions. Duodenal ulcer was found alone in nine cases; duodenal ulcer with one or more gastric ulcers in thirteen cases. Again, it should be said that the co-existence of duodenal and gastric ulcers was more often noticed in the later cases. The great majority of the ulcers were in the pyloric third of the stomach. It was rare to notice one within the cardiac third. Adhesions which were noticed in twenty-two cases varied greatly in extent and in complexity. In two cases there was a history of the perforation of an ulcer, so diagnosed by the medical man in attendance; in both of these the whole stomach was densely adherent, and it was with difficulty that so much of the stomach was cleared as to allow of a gastro-enterostomy being performed.

Fifteen cases were operated upon for hæmorrhage. Of these one patient, aged sixty-two, died. The only other fatal case was in a man aged twenty-eight. This patient died of a strangulated internal hernia. All the small intestines, with the

exception of about fifteen inches of the lowest ileum, had passed through the opening in the transverse mesocolon into the lesser peritoneal cavity and had become strangled by the margins of the opening. In performing the operation upon this case, I was conscious of having made the tear in the transverse mesocolon larger than usual.

In several of the cases, the patients complained of little more than severe, intractable dyspepsia. It was quite an ordinary history for a patient to say that his or her trouble came on " in attacks ;" that in the intervals there was comparative comfort, though solid food could not be freely taken, and that relief was sought because the attacks were becoming more serious and the intervals were shorter. Vomiting was often inconspicuous as a symptom, and in some cases the patient said that she had never vomited. On inquiry, it was found that such a patient had been compelled, owing to pain and the sense of impending sickness, to curtail the diet, to omit first one and then another article of food, until little but milk or Benger's food was taken. Vomiting was not present because it was never elicited. A patient who had vomited frequently and in abundance would often be entirely free from any sickness while resting under observation in hospital. In all, vomiting had been observed as a repeated occurrence in forty-four cases.

Hæmatemesis had been recognized, apart from those cases operated upon because of the hæmorrhage, in twenty-one cases. Melæna was observed alone in three cases, in all of which a duodenal ulcer was found. Hæmatemesis and melæna were observed together in six cases ; in four of these gastric ulcers alone were found, in two, both duodenal and gastric.

Pain was the most constant and the most distressing symptom. It appeared sometimes before a meal was finished, sometimes half an hour or an hour afterwards. A " hunger pain," a pain eased by the taking of food and appearing two to four hours after the meal, was noticed in cases both of gastric and of duodenal ulcer, and was always associated with hyperchlorhydria.

Hæmorrhage was the immediate and determining cause of

operation in fifteen cases. In all of these there had been symp-
toms of stomach troubles for a shorter or longer time before
the onset of the bleeding. I have elsewhere discussed the vari-
ous forms of hæmatemesis dependent upon gastric ulcer, and I
need only say here that the points which determine one to treat
such a case surgically are the recurrence of the hæmorrhage and
its quantity. Several of these patients were in a desperate con-
dition. In five of them saline intravenous infusion was em-
ployed at the time of the operation; from three to five pints
were given according to the patient's needs. The hæmoglobin
percentage was 18, 22, 25, 28, and 33 in five of the most serious
cases; in the rest it was above this point, or was not recorded.
In all these patients, gastro-enterostomy alone, without the ex-
cision of the ulcer, was performed; in not one of them was
there any trace of renewed bleeding after the operation. There
is, without doubt, a very remarkable tendency to spontaneous
cessation in gastric hæmorrhage. In hæmorrhage from what
is known as an " acute" ulcer, one of the most assured events is
the spontaneous cessation of the bleeding. Though the hæmor-
rhage may be copious and most alarming, it is rarely fatal. In
chronic ulcer, the same tendency is noticed; and indeed, in some
cases in which an operation has been performed, the ulcer has
been found, and the bleeding vessel has been seen plugged with
a firm clot. The factor which determines a recurrence of the
hæmorrhage is, according to my observation, distention of the
stomach. In one case I had to puncture the stomach to let out a
large volume of gas before I could manipulate it, and secure it
with a clamp as a preliminary step in the performance of gastro-
enterostomy. In all the cases upon which I have operated, this
distention of the viscus has been observed, and in some it has
been phenomenal. It is, I consider, the stretching of the ulcer,
caused by the distention of the stomach, which is chiefly re-
sponsible for the repetition of the hæmorrhage. In one case,
not in this series, I have excised the ulcer. The question as to
what is the best method of treatment in hæmatemesis treated
surgically has been much discussed, and the question remains
still unsettled. There are some who advocate the opening of

the stomach and the search for the ulcer. There are others who, ignoring the ulcer, hasten to perform gastro-enterostomy in the belief that this will secure the spontaneous arrest of the bleeding. My own feeling is that if the ulcer is readily found it may be excised, but in any case gastro-enterostomy should be performed as well. For the ulcer may be difficult or impossible to recognize; it may not be single; and if, therefore, one ulcer is excised, another may be the source of the hæmorrhage, and the hæmorrhage continuing may prove fatal. Two cases of this kind, at least, are recorded. That gastro-enterostomy will secure, or at least go far to securing, the arrest of the bleeding (by emptying the stomach, as I think), I submit that my record of cases undoubtedly shows. Whether, therefore, the ulcer be excised or not, a gastro-enterostomy ought certainly to be performed.

In three patients regurgitant vomiting was observed; in one of the patients the vomiting ceased on the tenth day after the stomach had been washed out once; in another, the painless vomiting of bile continued for nearly a year; in the third case, I was dissatisfied with the appearance of the anastomosis as soon as my suture was completed. There had been, about two years before the operation, a perforation of an ulcer in the stomach, and there were the utmost complexity of adhesions all round the stomach, which greatly distorted its outline. There appeared to be a kinking at the point of junction of the jejunum with the stomach, and I was tempted to perform entero-anastomosis then and there. I did not do so, however; but when vomiting of bile commenced, as I feared it would, directly the patient came round from the anæsthetic, I reopened the abdomen and joined the afferent and efferent loops of the jejunum. One hundred and thirty-two ounces of bile-stained fluid were vomited within fifty-four hours of the original operation; after the second operation there was no vomiting. The causes of the " vicious circle" or " regurgitant vomiting" have been difficult to discover. It was supposed that the presence of bile and pancreatic juice in the stomach excited the act of vomiting; but a case of my own, in which, owing to a complete rupture of the bowel at

the duodenojejunal flexure, I had to close the duodenal end and implant the jejunal into the stomach, proves without question that these fluids are harmless. For in this case all the bile and all the pancreatic juice passed into the stomach, yet digestion proceeded as before, and the boy ate well, enjoyed perfect comfort, and gained in weight. The correct explanation of the cause of regurgitant vomiting in some of the cases was first given by Dr. Mayo, of Rochester, Minnesota. He showed that if the anastomosis were made at some distance from the greater curvature on either the anterior or the posterior surface, a pool of fluid collected below the opening, and there being stagnant, excited the act of vomiting. He urged that the anastomosis should always be made as close to the greater curvature as possible. Since making sure, in all my operations, that the lower end of the opening was at the greater curvature, I have never seen the vomiting of bile in any case. There are cases, however, to which this explanation does not apply. In these there is an acute kink at the point of anastomosis, and the symptoms are those of intestinal obstruction high in the small intestine. In such circumstances the bile and pancreatic juice regurgitate into the stomach through the pylorus.

Gastric tetany has been observed in greater or less severity in five cases. In three it was slight and affected only the hands, forearms, and the calf-muscles. In two it affected these muscles, the neck muscles and the abdominal muscles, and in both the patients experienced the utmost agony, one of them repeatedly expressing a hope that she might die, to be spared future attacks. In one case, tetany affecting the hands and forearms was observed in a patient on several occasions during the first few days after the gastro-enterostomy had been performed. This patient, who had a very dilated stomach and a markedly stenosed and thickened pylorus, told me at the time that she had never previously suffered from such attacks, but within the last month she has called to tell me that a relative with whom she then lived had reminded her that she had suffered from cramps of the hands, with the typical " obstetric position," ten years before. Whatever the cause of gastric tetany may prove to be, there can

be no doubt that the disease in its severer forms is a complication of old-standing dilatation of the stomach that can be prevented by the earlier performance in these cases of gastro-enterostomy.

Chest complications were seen in three cases; in one there was a sharp attack of pneumonia, in two there was acute bronchitis. In one case, not in this series, of malignant disease of the stomach and in one case of hour-glass stomach acute pneumonia has followed the operation. The symptoms have begun about the end of the second or on the third day, and the acute stage has lasted about one week. Many theories have been suggested to explain the frequency of pneumonia after operations in the upper part of the abdomen. It has been attributed to exposure, to embolism, to the fixing of the upper abdomen by the patient in the unconscious effort to keep the wound at rest, and to the anæsthetic. Much has been written about this subject, but where there are many theories there is little knowledge. My own belief is that the pneumonia is septic in origin, and is due, in most cases, to the inhalation of putrid material from carious or unclean teeth. When a patient who is to have gastro-enterostomy performed comes to the hospital or to the Nursing Home he or she is supplied, as a routine, with a tooth-brush and a bottle of an antiseptic mouth-wash, and instructions are given that the teeth are to be brushed freely every two hours. In addition, all food given is liquid and is sterilized. If the patient is admitted on Monday at noon, for example, five grains of calomel are given on Monday evening, a saline aperient on Tuesday morning, and an enema on Tuesday night. The stomach is washed out on Monday evening or Tuesday morning, as is convenient, the washing being continued until the fluid returns quite clear, and a second washing takes place about an hour before the operation. The operation is done on Wednesday morning. The importance of the cleansing of the mouth and of the sterilizing of the food was conveyed to me by the work of Dr. Harvey Cushing, of Baltimore.

After the operation, the patient, when in bed, is propped up in the semirecumbent position by five or six pillows, or by the

bed-rest. If the patient is very ill and in urgent need of fluid nourishment, water, milk, or other fluid is given at once in small doses quickly increased. Saline enemata of five to six ounces, with or without brandy, are given every four hours, and a simple aperient enema is given every twenty-four hours. The toilette of the mouth is still carefully supervised.

The anterior operation of Wölfler was performed in five cases, the posterior of von Hacker in ninety-four cases, Roux's operation in one case. My choice of this last method was due to the fact that, owing to the perforation of a duodenal ulcer for which I had operated several months before, there were many adhesions crippling the stomach and warping its outline. In a previous almost exactly similar case, already mentioned, I had been compelled to reopen the abdomen and perform an entero-anastomosis. In any case of this kind, in future, I should adopt Roux's procedure. It is ideally perfect as a method of gastro-enterostomy. It reproduces almost exactly the normal condi-tions. Its sole disadvantage is that the time necessarily ex-pended in the operation is at least ten minutes longer than in an ordinary posterior gastro-enterostomy. I am so satisfied, how-ever, with the results of the posterior operation, and with the perfectly uneventful course of the great majority of the cases, that there does not seem to me to be any need for the routine adoption of Roux's method.

In ninety-two of the cases, the result of the operation has been from the first as satisfactory as could be wished. Appetite has soon returned, and food has been taken in any quantity with relish. All these patients have gained in weight, the gain vary-ing in amount from seven pounds to four and one-half stones. In the remaining six cases the after-history has not been so good. In every one of these hyperchlorhydria was pronounced before the operation, and has proved a source of pain and inconvenience afterwards. Of the six patients, three have improved greatly under medical treatment, continued for three to five months, and are now quite well; one is almost well, and two are still under treatment. The last three have all been operated upon within the past eight months. It is possible that in some of these cases,

owing to the excess of free hydrochloric acid, the mucous membrane in the distal limb of the jejunum has been digested, forming a peptic ulcer, and that this has caused some of the symptoms from which the patient has suffered. The six cases are the only ones that have not been completely successful. They have shown me that when hyperchlorhydria is present as a prominent and enduring symptom, some preliminary treatment by diet and alkalies may be desirable.

In two cases the condition was diagnosed before operation as malignant, and the appearances found at the operation were taken as confirming the diagnosis. Yet malignancy is disproved by the fact that both patients have gained over three stones in weight, and remain perfectly well, though the operations were done in June, 1900, and in January, 1901. In one case, not included in this series, the induration at and near the pylorus was supposed to be simple in character, but the subsequent course of the case has shown that the condition was malignant. This may have been an error of diagnosis, or the case may be an example of " ulcus carcinomatosum," of the implantation of cancer upon the edge of a chronic ulcer. This case occurred early in my experience. I do not think that the differentiation between simple and malignant conditions in the stomach causes me any difficulty now.

In three cases, not included in this list, I performed pyloroplasty. The last operation was done in January, 1901. I do not intend to perform this operation in any subsequent case. Gastro-enterostomy is, in my judgment, a much more satisfactory method of dealing with any condition of pyloric stenosis. (This criticism does not apply to Finney's operation of gastroduodenostomy or pyloroplasty.) The operation of gastro-enterostomy is so safe and its results are so good that I cannot doubt that it is the most desirable operation in all cases of chronic gastric ulcer. Its success depends in no small measure upon care in the preparation of the patient, speed in operating, the choice of a method which is simple, and which does not need a long exposure of viscera, and upon many details in after-treatment. Excision of an ulcer is perhaps desirable in some special instances, but the

main indication to be fulfilled is drainage of the stomach, and, to secure this, gastro-enterostomy should always be performed. In many cases in this series the patients were extremely ill, wasted, and enfeebled to the last degree, and it was only by the exercise of the greatest care that the operations proved successful. There are at least a dozen cases that one would not have been surprised to lose. Now that the mortality is reduced to so small a figure as 2 per cent., the surgeon may not unreasonably expect that, from being a last and sometimes desperate resource, gastro-enterostomy may be considered as a method of treatment worthy of consideration in a much earlier stage of chronic ulcer of the stomach.

POSTOPERATIVE PNEUMONIA, WITH EXPERIMENTS UPON ITS PATHOGENY.

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SINCE this is one of the few subjects which is not adequately covered in medical literature, and since postoperative pneumonia has almost invariably been attributed to the anæsthetic, no apology is needed for inviting the attention to a brief discussion of the subject, to views taken at a new angle, and to a few experiments which may have some clinical significance.

No complication is more dismaying to the surgeon or more disastrous to the patient, and it would seem that any light which may be shed upon its etiology or suggestions as to its prevention should be most welcome. Occasionally, after an operation performed with the requisite speed and technical skill, the temperature rises with an initial chill, increased pulse-rate, and systemic depression which at first suggest sepsis, and show for their only cause a percussion area on the chest, a few moist or crepitant râles, all progressing rapidly to a fatal end.

What, then, may be the causes of this complication? What is there in the surgical state which renders a patient more susceptible to pulmonary infection at this particular time? Is it the ether, the reduced condition of the system caused by those factors which make an operation necessary,—a cold operating table with cold water for " washing up"? Is surgical pneumonia different from any other? Did pulmonary disease exist before a pneumonitis developed, or was there a particular opportunity for an infection? All these questions are interesting and important in the *rationale* of an individual case.

Of especial interest, however, is the possibility of a pneumonia already existing in a latent state or in a typical form. Knowing as we now do the great frequency of these forms of

700

pneumonia as contrasted with the frank, undoubted variety, and the great commonness of cases which have at first but little elevation of temperature and practically no physical signs, is it at all remarkable that occasionally consolidation shows itself a few days after an operation of no particular severity or danger? Again, it is impossible to overlook the element of chance in reviewing the likelihood of pneumonia after an operation. We do not as yet know whether the prevalence of pneumonia at certain seasons is due to climatic changes, a state of particular virulence of the bacteria, or both; and it seems that nothing could be more unreasonable than to ascribe to the anæsthetic a disease quite prevalent among those not affected with surgical ailment.

Statistics are of but little value in an inquiry into the etiology of this disease. That different observers found it to occur once in a certain number of cases throws no light whatever on the subject further than to show that it occasionally does occur after an operation. Prescott, in reviewing 40,000 cases at the Massachusetts General Hospital, found but three cases; Silk reports thirteen in 5000 surgical cases, and Anders, in a review of 12,842 surgical cases, found thirty. Kelley has seen eight cases in 1800 administrations of various anæsthetics, and is of the opinion that coryza as well as bronchitis predisposes to the complication. The writer, in a necessarily limited experience, has a knowledge of five cases, and is of the opinion that the condition is of much greater frequency than these reviews would indicate.

Various vasomotor changes result from the necessary circumstances of an operation. Conspicuous among these is the exposure of the body surface to a temperature of 70° F. or under, cleansing solutions may be cold, and if the clothing be wet the patient is swathed in a cold poultice at a time when he should be protected from such an influence. We have in these precisely the same factors which are accounted as causes of colds, respiratory and the so-called rheumatic disorders with the added changes in the peripheral circulation incident to the anæsthetic. These vasomotor changes are prime features in surgical shock,

and for this reason a warm bed with heaters should await the patient, and be maintained until circulatory equilibrium has become re-established. If the operation be upon a patient reduced by long-continued illness, external or concealed hæmorrhage, or if there is a possibility of collapse or death on the table, everything should be done to maintain the body temperature. Among the various means to this end the hot-water mattress is of particular importance.

As to the ability of ether to produce pneumonitis, some affirm it, others deny it, but all dread it. For years the necessity of careful dosage in anæsthetics with the view of reducing shock, irritation, and vomiting to a minimum has been urged; and, although it would seem that the application of these principles would lessen the possibility of postoperative bronchitis or pneumonia, we have as yet no convincing data that ether is a prime or direct cause of pulmonary complications. Indeed, it is claimed by some that pneumonia occurs quite as frequently when local anæsthesia is used. Experimentally, it is not at all easy to produce pneumonia. Aufrecht could not produce it in healthy rabbits by subcutaneous or intrapulmonary injection of pneumonic sputum, and after an interesting series of experiments concludes that a pre-existing pathological lesion is necessary for the deposition and multiplication of pathogenic bacteria. Grave pathological conditions (abscesses) and death may be caused, but not pneumonia. That bacteria are found in the bronchioles, and even in the finest ramifications of the air-passages under certain conditions, cannot be doubted, for Klipstein found that, although they were normally absent from the trachea, bronchi, and lungs of cats, dogs, and rabbits, they might be found in abundance after etherization. In the experiments of Lindemann, carmine was introduced into the mouths of rabbits, and after the animals had been etherized, particles were found in the smaller ramifications of the bronchi, having been carried there by the violent inspiratory efforts incident to the etherization. The writer also finds bacteria in the lungs of healthy rabbits.

It is fair to presume, however, that a theoretically perfect

epithelium is able to resist the ordinary invasions of bacteria:
and it seems reasonable to suppose that any damage to the
tissue would render the individual more susceptible.

Surgical pneumonia then may be divided into two classes,
—one in which infectious particles are drawn into the lungs by
the violent inspiratory efforts incident to anæsthesia, the other
in which organisms of particular virulence find soil suitable to
their growth and multiplication.

I have the honor of presenting a brief account of a few
experiments upon the irritant effects of ether. It is a funda-
mental principle in pathology that a perfect tissue is less liable to
infection or other degenerative changes than one previously
injured or diseased. Cancer invades abraded and cicatricial
tissue, the diphtheria bacillus finds a fruitful soil in the catarrhal
pharynx, pneumonia and bronchitis more quickly attack those
with pre-existing pulmonary lesions, and sepsis attacks abraded
rather than unbroken surfaces. Without elaboration of the
reasons why this is so, it may be stated that any evidence that
the inhalation of a vapor produces structural changes in the
lungs, thereby opening increased possibilities for bacterial lodge-
ment, may serve as an explanation of postoperative phenomena.
The inhalation of silicious particles causes minute wounds upon
which tuberculosis may develop; perhaps the minute hæmor-
rhages which we shall see take place in the lungs in prolonged
or careless anæsthesia, may serve for the subsequent develop-
ment of pneumonia if the specific bacteria be brought to such
lesions before they are healed. With this in mind, I have made
a number of experiments with rabbits to see if possible whether
the irritant effects of ether reach down into the lung tissue, or
are confined to the larger bronchial tubes, and whether etheriza-
tion increases susceptibility to pneumonic infection. Securing
first a normal lung by decapitating the rabbit, for suffocation or
brain puncture causes engorgement of the pulmonary vessels
with rupture of the alveolar capillaries, sections were prepared
by fixing and hardening in Zenker's solution and alcohol and
embedded in paraffin. Sections were for the most part five
microns in thickness and transverse to the tubules. The next

step was to observe the effect of ordinary etherization on the rabbit's lung, and to this end ether was given by an inhaler for half-hour periods on three successive days, the lung being then prepared for observation as that of the control normal rabbit.

In order to see if a normal rabbit would acquire pneumonia if given ample opportunity, it was caused to inspire an atmosphere saturated with the diplococcus pneumoniæ, and to ascertain if a rabbit previously etherized was more susceptible, it was caused to inhale the same atmosphere.

To observe the effect upon a capillary net-work similar to that of the lung, the web of the frog's foot was made use of, and to learn the effect of ether itself on the lung it was injected directly into the lung tissue of the living animal by a hypodermic syringe.

I. *Effects of Ether on the Frog's Web.*—In observing the frog's web before, after, and during exposure to ether, it was found that the effects of liquid ether and its fumes were the same in kind, the former acting more quickly. Macroscopically, the foot presented the appearance of intense congestion, dark and livid. Microscopically, it was found that all circulation had ceased, the blood in the vessels having become stagnated and presenting a mass of corpuscles packed so closely as to seem homogeneous. The larger blood-vessels could be made out, their contour unaltered, but the smaller capillaries seemed identical with the tissue. After a time, however, if the ether be removed, the circulation gradually asserted itself, feeble impulses could be detected in the arteries, which then become larger in caliber, and little by little with increasing impulses the solidified mass becomes broken up and is fluid again. Nearly an hour is required to completely restore the circulation after five minutes' exposure of the foot to ether fumes. Immediately upon the appearance of the slightest circulation, leucocytes appear in the lumen of the vessels, proceeding from the perivascular tissue, and these associate themselves with the vessel wall, adhering to it in spite of the ceaseless impact of the red corpuscles in the blood stream. In a few minutes these have

formed a complete lining for the vessels, and gradually the contour of the individual corpuscles is lost and a new endothelium is formed. In occasional instances the capillary wall was ruptured, so that the corpuscles poured out in a broad stream unrestrained by lateral walls, forming a true subcutaneous hæmorrhage easily seen by the unaided eye. To show that these phenomena were not due to refrigeration from the evaporation of the ether, ice and ice water were applied to the frog's foot, but only a slowing of the blood current was observed. The restoration of the circulation after as brief an exposure as five minutes is not always complete; some of the vessels may remain clogged and never become cleared, others regain their function for a time, but later fill up with agglutinated reds. If the exposure is as long as ten minutes, the tissue is killed and the circulation entirely destroyed, and after a few hours the integument peels off in strips over the entire area of exposure. The tissues underneath are devoid of circulation, and in a few days the flesh sloughs off, leaving only the skeleton.

We may conclude, then, that in the frog's capillary web ether causes arrest of the circulation, rupture of the bloodvessels, and in general phenomena of an inflammatory and hæmorrhagic nature with death of the exposed tissue, and that these effects are specific to ether and not the result of refrigeration. And it is interesting to note how short an exposure will cause these changes. From these observations, it was predicted that the changes produced in the lungs, if any, would be of the nature of hæmorrhages, a surmise that was fully realized.

II. *Effects of Ether upon the Lung.*—When ether is injected into the lung tissue of a live rabbit, the animal emits a few frightened cries and gives a few struggles, after which it remains quiet. For three or four minutes there is slight disturbance of equilibrium, but at no time is there anæsthesia. Râles appear at once in the chest, and are observed with stethoscopes of various kinds, the Bowles being the most satisfactory. The respirations and heart are

23

greatly accelerated, being doubled in velocity and of the ratio of
one to two.   Ten minutes after the injection of five minims of
ether the pupils react to light, ether can be detected in the ex-
pired air, the respirations are labored, and the nostrils dilated,
giving the characteristic appearance of air hunger.   After this
there is but little change in the animal's condition until its
death, which occurs some ten hours later; the pulse remains
about 200, the respiration 100; there is diminished respiratory
movement of the affected side, a percussion area can be made
out over the site of the injection.   The respiration is distinctly
bronchial over this area, the râles being loud and of all grades,
from small sibilant to noisy rhonchi.

Necropsy upon this animal shows the tissue around the site
of injection to be a mass of hæmorrhagic tissue which is solid,
sinks in water, and is of a dark red color.   There is a large mass
of clotted blood in the cavity, adherent to the lung tissue and
evidently proceeding from it rather than from the chest wall.
The other lung shows areas of ecchymosis, but is otherwise
normal, and a tendency towards those features found nearer the
site of injection.

Microscopically, it is found that the structure of the lung is
so completely changed as to leave but little resemblance to the
normal.   As seen by the microphotograph (Fig. 2) there is
hardly a vestige of normal lung tissue.   Instead there is a homo-
geneous mass of agglutinated red blood-corpuscles dotted with
nucleated cells which are leucocytes and cells from the alveolar
walls.   The more remote from the point of injection, however,
the more normal does the tissue appear; and it is possible to
select areas which can be recognized as lung tissue.   Even in the
other lung we find alveoli filled with hæmorrhagic exudate,
thickened walls, and nucleated cells proceeding from them into
the spaces.   The exudate in this experiment is of two kinds,—
one of broken-down lung tissue with connective-tissue cells
closely packed together, the other of a hæmorrhagic nature,
consisting of blood extravasation agglutinated into a finely
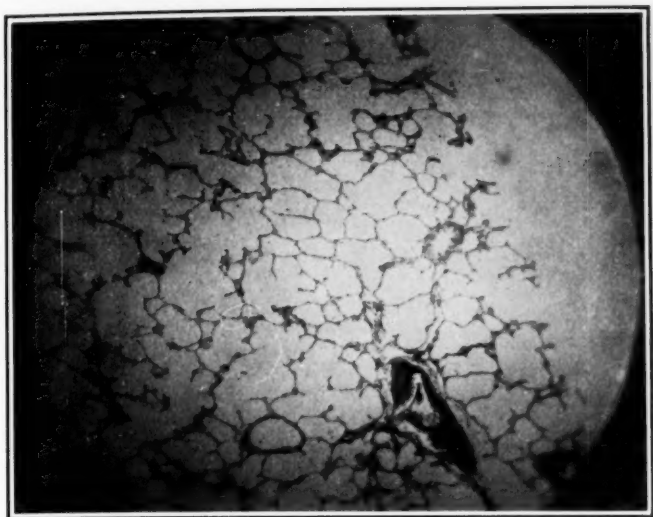granular homogeneous mass.

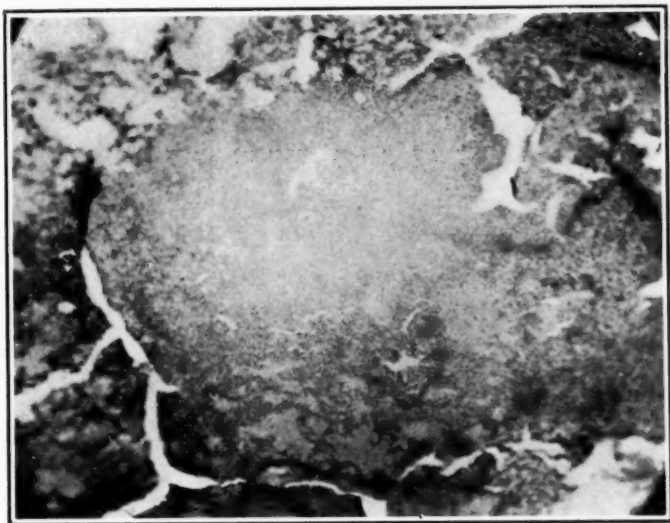FIG. 1.—Section of lung of normal rabbit. × 87.

FIG. 2.—Section of rabbit's lung into which ether has been injected. Lung structure is completely lost; there are no vestiges of alveoli or walls; the almost homogeneous mass is composed of red and white blood-corpuscles with nucleated cells of the destroyed lung tissue.
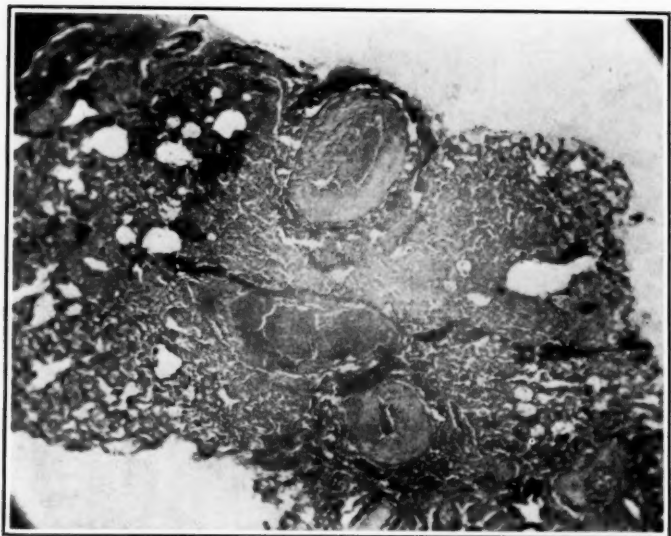
FIG. 3.—Section through hæmorrhagic area of an etherized rabbit. Showing only suggestions of alveolar structure, the blood-vessels having ruptured and the alveolar walls having become agglutinated. This section is longitudinal to the alveolar ducts.
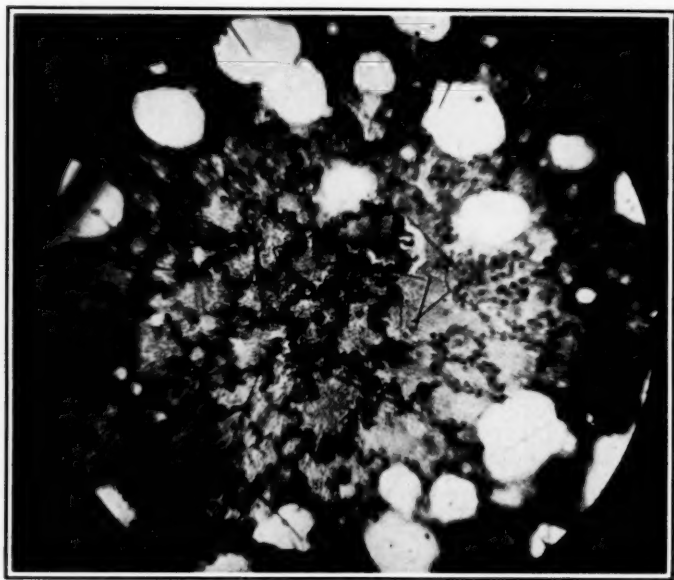
FIG. 4.—Etherized rabbit caused to inhale vaporized culture of pneumonia germs. Almost complete consolidation of the lung. The alveolar walls may be made out, but the spaces are filled with exudate. The walls are engorged, and reds may be seen proceeding from them.

III. *The Effects of Ether Anæsthetization.*—*Macroscopically*, the lung of a rabbit previously anæsthetized shows dark red mottlings which for the most part are superficial. These are distributed over the surface of the lung and comprise a third of its external area. These are the areas over which râles were most distinctly heard during the etherization. It was thought, inferred from the observation of the frog's circulation under ether, that these mottled areas were hæmorrhagic in their nature, and microscopic examination shows this to be the case. The alveoli are swollen and full of corpuscles, the bronchial tissue is congested, and in many cases the corpuscles may be seen proceeding from the tissue into the alveoli and peribronchial spaces (Fig. 3). Experiment readily shows the increased susceptibility of rabbits to the irritant effects of ether with successive etherizations, for when one is carefully anæsthetized râles appear in the chest in about a half an hour. If, then, this rabbit be undisturbed for two or three days and again anæsthetized, they appear in about fifteen minutes. A third anæsthetization causes râles and rhonchi to appear in five minutes or less. It is interesting to note, also, that the forcing or crowding of the anæsthetic causes these features to appear in a very much shorter time. Furthermore, it is found that the microscopic changes in the lungs vary from the condition of congestion of the alveoli to actual intra-alveolar hæmorrhages, according to the care taken in the etherization, very short etherizations causing but little change in the lungs.

IV. *Etherized Rabbit Plus Pneumonia Culture.*—To learn if a rabbit previously etherized would acquire pneumonia, or if an infection would have any effect upon the lesions caused by ether, one was etherized for half an hour on three successive days, and in the intervals it was caused to inspire an atmosphere laden with Fraenkel's diplococcus pneumoniæ. Cultures of this organism were very kindly furnished me by Dr. Augustus Wadsworth, of Columbia University, and were administered by diluting with water and vaporizing in an ordinary nebulizer. To avoid scattering the bacteria, the rabbit

was caused to inhale through an aperture in a box which closely fitted its nose, and the vapor was introduced through a small aperture at the opposite end. This animal was certainly ill, refused its food, and its rate of respirations was distinctly increased. No râles could be detected, and the respiratory murmur was slightly increased. There were no percussion areas.

Macroscopically, the lung presents all the features of that already described as incident to etherization, but all are advanced and intensified. Its surface is studded with areas of irregular outline of a dark reddish-brown color; the peribronchial tissue is almost black and nearly solid; parts of the lung do not crepitate and nearly sink in water, and the abnormal tissue is not superficial, but massive, extending deeply into the lung tissue.

Microscopically, the findings are most interesting and fairly well shown in the microphotograph (Fig. 4). In these sections we have all grades of pneumonitis, from mere congestion, with but slight change from the normal, to actual consolidation of lung tissue. Selected areas show the typical picture so often seen in croupous pneumonitis,—the alveoli preserved in outline, but completely filled with exudate, which in some cases rests upon a delicate reticulum. The areas around the bronchi show a marked degree of peribronchitis, and the lumen of the bronchi are for the most part filled with exudate. When stained by Gram's and other methods for bacteria and capsules, an organism is found which is identical in morphology and staining properties with that used in the experiment.

The significance of this experiment depends not only upon the findings of the preceding one, but also upon those in a

V. *Normal Rabbit caused to Inhale Culture.*—This animal, although it showed slight lassitude for three days, did not refuse its food, and showed no elevation of temperature or increase in respiration.

Macroscopically, the lungs showed no abnormality whatever. There was no mottling, no signs of hæmorrhage, no change in the normal crepitation.

Microscopically, the sections showed a thickening of the alveolar walls, but without consolidation of tissue, peribronchitis, or exudate of any kind. The bacteria used in the experiment was occasionally found in the alveolar spaces and walls. In this animal we have a nearer approach to the normal than any in the series, and it is quite easy to find areas which show no abnormalities whatever.

VI. Finally, with the idea of learning if complete resolution took place in the lung of an etherized rabbit not influenced by infection, one was etherized until râles appeared in abundance, and after two weeks this animal was killed. It was found that the lungs showed the hæmorrhagic areas partially resolved, but still distinct; and it was deduced that some time must elapse, in the rabbit at least, before the lung is again normal. It would be an interesting and practical problem to make a series of experiments along this line with a view of determining the amount of time required and the manner in which resolution takes place.

The following conclusions seem justifiable and may be defended:

1. Prophylaxis. Care in ether giving lessens shock and respiratory irritation, which reach their maximum when an unnecessarily large amount of ether is given.

2. The disinfection of the mouth and oropharynx by peroxide before operation is a rational precaution.

3. Adequate air space is of even greater importance in surgical wards than in medical.

4. A careful auscultation and percussion of the chest should precede every operation, and if there be signs of disease, operations of election should be postponed until the chest condition is more favorable.

5. A complete clinical record of all cases of postoperative pneumonia, together with a record of the previous state of the patient, is most desirable, and such records will in time greatly enrich our incomplete knowledge of the factors which predispose to the complication.

6. It is possible to demonstrate experimentally the lesions produced by suffocation and etherization, and the same philosophy which explains postoperative pneumonitis may be applied to that which occasionally follows poisoning by carbon monoxide and illuminating gas.

THE DIAGNOSIS OF ABSCESS OF THE LIVER.

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ABSCESS of the liver occurs in a variable percentage of cases dying from amœbic dysentery, according to the statistics of different investigators. Woodward, for example, collated the autopsy records in 3680 dysenteric subjects, and found 21 per cent. having abscess of the liver. Boston, in a similar collation of 2430 dysenteric autopsies, found 20 per cent. with liver abscess. The annual report of the Sanitary Commissioner with the Government of India for 1894 shows that 35 per cent. of the European soldiers who died from dysentery in India had pus in the liver. These statistics, based upon autopsy findings, while interesting from the pathologist's stand-point, and instructive in emphasizing the importance of one constantly bearing in mind the possibility of liver-pus complication in dysenteric cases, do not however reveal the true relation between the disease dysentery and its most common complication or sequel, for they do not include the whole mass of dysentery cases treated during the time, and in the locality, in which the disease was rampant, and from which the autopsy records were made. The figures do not include the number of cases that recovered, with the number that succumbed to the primary disease or its complication, and therefore do not give the surgeon a correct idea as to the frequency with which he may expect a suppurating liver in his dysenteric patients. In order to ascertain this relative frequency of abscess formation, while in charge of the surgical work, I investigated the records of the First Reserve Hospital, Manila, P. I., in 1901, the data covering a period of over two years, and found that liver abscess occurred in slightly less than 5 per cent. of dysentery patients among the American soldiers in the Islands. A like computation was recently made by Dr. Craig, at the Army General Hospital, Presidio of San Fran-

711

cisco, the principal receiving hospital in the United States for patients from the various military hospitals in the Philippines, and he finds that the percentage of liver abscess complication of amœbic dysentery cases treated in this hospital during the past five years is approximately the same,—5 per cent. This number then (one abscess of the liver to every twenty cases of amœbic dysentery) may be accepted as the relative frequency with which we have to deal with liver-pus complication in patients who have contracted dysentery in the Philippines, and in view of the increasing traffic between our country and the Island ports, with large numbers of dysentery patients returning yearly to our shores, the subject will be of some interest to physicians under whose care these cases eventually come for treatment.

The estimate given has no reference to the type of dysentery indigenous to our own country, for it is a well-known fact that abscess of the liver is a rare concomitant of dysentery contracted within the limits of the United States. During my service as Assistant on the clinical staff of one of the largest hospitals in an Eastern city, covering a period of nearly five years, I recollect but one case of abscess of the liver, of unknown origin, treated in that institution. Neither has the estimate any reference to the disease contracted in any other tropical country than our Island possessions, for, as Manson has pointedly stated, drawing his conclusions from a large experience in the study of dysentery in warm climates: " Even in hot countries the dysentery of some places is more apt to be followed by liver abscess than is the dysentery of other places," and in Egypt and India, for example, where the disease is particularly common, it may be that hepatic abscess is a more frequent complication than our experiences have shown it to be in the Philippines. Those patients having dysentery contracted in the tropics and who come to us for treatment, will however be principally those returning from the Islands, and in 5 per cent. of these cases we can count on liver infection.

The ability to recognize this liver complication is of course of paramount importance to the surgeon who would deal suc-

cessfully with such cases. It is hardly a credit to us to read that, out of so many hundreds of dysenteric cases coming to autopsy, a large number are discovered by the pathologist as having liver abscess unrecognized on the sick-bed. Such findings will be less common as our knowledge of the disease increases, and the liver condition is diagnosed while it is still operable. That this is possible in every case has been proved by the experiences of the staff at the Army General Hospital in this city, where since the fall of 1902, to my personal knowledge, among seventy odd cases that have died from dysentery, but one case of liver abscess found its way to the post-mortem table undiagnosed; and this was a suspected case, but unwarranted dependence on the aspirating needle as a diagnostic means led to delay in decisive action until the patient succumbed to pleural rupture. During this period twenty-four cases of liver abscess were operated upon.

The diagnosis of liver abscess can best be set forth by describing a typical case, keeping in mind at the outset that we are dealing with a complication, or a sequel, of dysentery, and that the pus formation in the liver never antedates the pathological lesion in the bowel. In the majority of cases a history of a previous dysenteric attack can be elicited from the patient, but the absence of such history should not mislead us into a wrong conception of the relationship between the two diseases. Extensive dysenteric ulceration may exist in the bowel, and in some instances give rise to no active subjective symptoms whatever, so that the patient may be unaware of his intestinal condition; or slow forming minute intestinal ulceration, with slight change in the character of the stools, may pass unnoticed by the patient until he presents himself with hepatic discomfort. I have witnessed the post-mortem dissections of patients with multiple abscesses in the liver who denied ever having had any looseness of the bowels, or ever having seen any evidence of blood in the stools; yet the characteristic ulcers were prominent in various portions of the large bowel and ileum. These cases are the dysenteric analogues of " walking typhoid" patients fre-

quently met with, and in whom, notwithstanding the latency of symptoms, the intestinal lesions exist.

The failure of the surgeon to at once elicit the history of an antecedent dysentery may also be due to a faulty recollection or a misconception on the part of the patient which leads him to make erroneous statements that can be corrected by careful inquiry into past habits, a circumstance which was impressed upon me on several occasions, when patients presenting themselves with a suspicious liver condition denied ever having had a previous dysenteric attack, yet close questioning brought forth the information that a slight attack of " diarrhœa," or a " looseness of the bowels," occurring in the tropics, dated back one, two, or four years, and was entirely forgotten. Again, the puzzling autopsy reports of cases of amœbic abscess of the liver occurring independent of, or in the absence of, any bowel lesion may find explanation in the probability that dysenteric ulcerations of a small and superficial character are often either not sought for or are overlooked during evisceration of the subject, or, that having gone on to resolution, the minute scars pass unnoticed by the pathologist as he flushes the gut under the water-tap searching for macroscopic lesions. So that in those cases of liver abscess where a history of, or evidence of, antecedent dysentery is not obtainable, it must not be inferred that the disease never existed. On the contrary, I am prone to believe that all cases of amœbic abscess have a causal factor in bowel ulceration.

The case with liver abscess belongs to one of two classes : he is either a patient returning from the tropics suffering with chronic dysentery, and in whom the intercurrent hepatic lesion is discovered during the routine examination on his arrival; or, having returned from the Orient in fairly good condition at some previous time, a month, a year, or several years it may be, he now seeks relief from a gradually increasing hepatic disturbance, with a history of dysentery that may or may not be forthcoming. The one who is still suffering from a chronic dysentery on admission presents the well-known clinical aspect of this disease, plus the symptoms dependent upon the liver

lesion, and is therefore in a more precarious state than the one who was cured of his dysentery and who has enjoyed a period of respite from invalidism, but who is now suffering from its perilous sequel. The case in whom the bowel condition is in abeyance will have more clearly defined symptoms and will be more readily recognized; and once the local condition in the hepatic region is thoroughly understood the symptoms and signs dependent thereon may easily be isolated in patients in whom the abscess is a concomitant affection.

In describing a typical abscess case I have to take exceptions to the clinical picture of this disease presented by the leading European authorities on tropical diseases and their American editors. The picture drawn by these authors is that of a patient in whom the pathological process in the liver is far advanced, with neighboring structures seriously involved, and the abscess on the verge of rupture. To advocate delay until the abscess had reached such proportions before a diagnosis is reached is dangerous teaching. One would not consider it permissible to withhold diagnosis in a chronic appendicitis case under treatment until the organ was about to rupture and empty its purulent contents into the peritoneal cavity, and there is no more reason why the existence of pus in the liver should not be determined before the disease has advanced far and reached dangerous limits. The clinical features of the abscess in its incipient stage are sufficiently prominent to make it possible to recognize the condition early, and the efforts of this paper are directed to this end.

One is impressed at the outset on examining the patient that he is quite ill. He looks emaciated, usually from ten to thirty pounds under weight; his features are drawn and set, giving him the haggard expression of one who has suffered continuously for some time. His complexion is the ashy-brown color common to the chronic dysenterics who have seen several years' service in the tropics. His eyes are lustreless, and he looks from one object to another slowly and in a disinterested manner. He walks erect, but lacks activity. On questioning him in reference to his illness, he will state that for some weeks

past he has had an unaccountable languor and depressed spirits; has lacked interest in his surroundings, and feels irritable under the stress of work. He complains of feeling feverish towards evening, and is inclined to remain near a stove most of the time, but denies having had chills. His breath is foul and he has a dull headache, not very severe, but constant in the temporal or frontal region. His principal complaint, however, is a sense of weight and dragging in the right hypochondrium. He will give a history of a dysenteric attack in the tropics some months or years back, and during his service beyond the seas he was a moderate user of alcohol of mixed variety, and not always careful in the selection of food. With this information he will be put to bed, a four-hour temperature is outlined, a liquid diet is prescribed, and a copious dose of epsom salts (sixty grams) administered, even in the presence of dysentery, to deplete the abdominal viscera and thus facilitate examination on the following day. In the meantime a differential blood count will be made, the stool will be examined for amoeba and other parasites, his urine will be investigated, and if he has a cough with expectoration, his sputum will be examined microscopically. At the end of twenty-four hours a physical examination of the patient is made, the laboratory reports compared, and the following diagnostic points are searched for, set down in the order of merit:

1. Liver enlargement, with local tenderness and pain. The local liver condition, next to the dysenteric history, is naturally of first importance. With the patient in a prone position, lying on his back with his thighs flexed, the liver dulness is outlined by percussion.

In a case seen early in the course of the disease, or when the abscess is still small, the normal liver dulness may be increased but slightly,—a finger's-breadth on the upper or the lower border. In two cases on which I operated, having single abscesses the size of a hen's egg near the outer border of the right lobe, there was no apparent liver enlargement on percussion. In two other cases having abscesses of the same size,— one near the outer and posterior surface of the right lobe, the

other in the lobulus spigelii,—there was a slight enlargement, in the first case a finger's-breadth above the normal dome out-line, in the second case below the costal margin on the right side towards the median line. In the majority of cases that appear for treatment, however, the increase in dulness is marked: from two to six centimetres, even in abscesses of comparatively small proportions and without adhesions. The increased percussion dulness will generally be outlined by an arching of the upper border, and will be most prominent between the right nipple line and the anterior axillary line. It frequently extends to the level of the sixth or fifth rib in this locality, and shades off in a downward direction posteriorly to the level of the eighth or ninth rib, near the spine. In one-third of cases dulness extends below the right costal border. In such cases the patient is told to take a deep breath and to exhale it rapidly with his abdominal wall relaxed, and the surgeon's fingers are pushed gently but firmly below the ribs on the under surface of the liver as far as possible, to see if any mass can be discovered that would change the normal flat contour of the inferior surface. In some cases this fact can be ascertained, and the amount of pain elicited, and the degree of wincing exhibited by the patient will also be of diagnostic value. At times, in the effort to carry out this procedure, the surgeon will encounter a marked rigidity of the right rectus muscle in the epigastric region; but this is generally a temporary spasm, and the muscle will relax after several efforts at posterior pressure, and the patient's confidence is gained. This temporary reflex spasm must not be confounded with a fixed rigidity,—a later sign of liver abscess on the under surface in this region, and which means that the abscess has reached the surface of the organ at some point in the neighbor-hood, and the peritoneal surface is involved in the inflammatory process.

Increase in dulness, then, either towards the nipple or be-low the right costal border, is the rule in these cases, and signi-fies (other signs being equal) a pus collection in the right lobe, —the most common site of abscess. Seventy-five per cent. of cases on whom I have operated have had abscesses in the right

lobe; Craig reports the same percentage of right lobe infection in post-mortem work during the past five years. Roux gives the number 70.8 per cent. from a collective investigation at autopsy; so that the usual site of infection of those who die with the disease, and those who are operated upon and recover, is the same. The reason abscess of the liver occurs more frequently in the right lobe finds its explanation in the laws of normal physics. The amœbæ and other bacteria pass through the ulcerated surface of the intestine into the mesenteric veins and enter the vena porta, which passes upward to the under surface of the right lobe of the liver, entering the organ through the transverse fissure, where it divides into the right and left branches, supplying the corresponding lobes. The right branch, from its direction, is really the continuation of the main trunk, and being the larger, shorter, and more direct route for the blood stream, the more voluminous and swifter current will carry a preponderance of the bacteria or emboli containing them into the capillaries of the right lobe. Single abscess of the left lobe is a comparatively rare occurrence, and increased percussion dulness limited to this lobe is accordingly an infrequent phenomenon. When the left lobe is enlarged, the dulness is increased downward in the epigastric region, to the left of the median line, and approaches the splenic area. When dulness over the left lobe is markedly increased, it is generally in association with an increase in dulness over the remainder of the organ, a sign linked with the condition of multiple abscesses throughout the gland.

Inquiry is made as to the presence of pain. In the majority of cases the patient will complain of considerable discomfort or a dragging sensation in the hepatic region, and when asked to locate it he will usually place the palmar surface of his entire hand over the area where this pain is located. Although not a specific indication, this gesture will give an idea as to the area of the liver probably involved. If he places his palm near the rib margin, it may be presumed that a lesion exists near the under surface of the right lobe; if he marks an area higher up on the chest wall, it implies that the trouble

exists towards the upper surface of this lobe. This discomfort
is not always present, and may not be noticed by the patient
while the body is at rest, but on walking or engaging in any
exercise with jarring movements, the discomfort will assert
itself in marked degree.

Sharp, stabbing pains will be complained of by some pa-
tients, especially on taking a deep inspiration. The site of this
acute pain will be indicated at the point of the finger, and when
the patient gives us this information we may know that we are
dealing with a more or less advanced case; that the suppurative
inflammation has reached the surface of the organ; that ad-
hesions are forming or extending between the liver capsule and
the peritoneum at this point. Occasionally these acute lan-
cinating pains will be diffused over a wider area, and the patient
will not be able to locate the point of greatest tenderness him-
self. Careful search by the surgeon with the point of his finger
in an intercostal space, or deep down on the under surface of
the liver, will discover it. This point is a valuable diagnostic
sign.

2. Next in importance is the temperature. If the case be
a pure amœbic infection, with the abscess limited to the paren-
chyma of the organ and is unaccompanied by adhesions, the
evening temperature will average 100° F., the morning tem-
perature dropping to a range between 98° and 99° F. Forty
per cent. of cases appearing for treatment will have an evening
temperature hovering around the 100° F. mark. This is true
of large abscesses as well as small ones without mixed infection.
If the temperature rises to 102° F., or above, in the evening.
it means that we have, in addition to amœbic infection, a
staphylococcus or a streptococcus or a bacillus coli invasion, the
morning temperature in these cases being about the same as in
a distinct amœbic infection. This clinical experience has been
confirmed by examinations of the pus in the laboratory. In
over half the number of cases operated upon, the examination
showed a mixed staphylococcus and streptococcus infection in
the pus scrapings from the abscess wall. In three cases the

bacillus coli was found, but it existed in conjunction with other bacteria. If the case be a pure amœbic infection primarily, but appears for treatment late in the course of the disease, the pus accumulations having reached the surface of the liver and invaded the neighboring structures, the temperature range will be similar to that found in a mixed infection, and is presumably due to the fact that the pus organisms have been carried to the part by the blood stream during the process of adhesion formation between the peritoneal surfaces.

3. Of equal weight is the pulse-rate. The average evening pulse-rate in a simple amœbic abscess case, independent of the size of the pus collection, ranges between 90 and 100, the morning pulse being normal. While in a mixed infection, either within the abscess or in a coccus invasion on the surface of the organ, the evening pulse is always above 100 beats, averaging 110, the morning pulse keeping in the neighborhood of eighty-five beats to the minute. So that we can very often judge by the chart record as to the presence or absence of a mixed infection prior to operation.

4. The blood count reveals an increase in leucocytes, principally the polymorphonuclear variety, and in my experience the number is far lower than that usually quoted by authors in writing of this affection. The number varies largely, and no set figures can be given as to certainty. I have operated on four cases in whom the average leucocytosis of each amounted to 11,000. On the other hand, two cases showed a leucocytosis of 44,000, and one of 67,000. These high numbers are rare, however, and the average leucocytosis may be stated as 12,500. This will be true particularly in those cases appearing early for treatment, and in pure amœbic infection. A leucocytosis of even 1000 less is of diagnostic value. The blood count should be made daily at a stated time, for comparison, until the diagnosis has been decided upon.

The presence or absence of malarial parasites in the blood will have no significance in liver abscess, as they are not a causal factor in suppurative disintegration of the organ, and

the hepatitis which they cause is merely of a plastic nature and
never goes on to pus formation.

5. Distention of the vertical superficial, or subcutaneous
veins over the hepatic and epigastric regions, is a sign noted in
all cases, even in those in whom the pus collection is very
limited. It signifies a process going on within the liver, pre-
sumably inflammatory, which interferes with portal circulation,
and is marked in greater or lesser degree, according to the
extent of liver engorgement. The dilatation of the veins is
dependent upon the anastomosis between the portal system and
the subcutaneous veins on the lower chest wall and epigastric
region, through the veins in the suspensory ligament,—the
accessory portal veins of Sappey,—and the veins dilated are
the subcutaneous end branches of the superior epigastric and
internal mammary. These veins do not become tortuous, but
merely become more apparent beneath the skin layer in com-
parison with those upon the opposite side of the body, and their
appearance will act as a guide in a general way to the location
of an underlying suppurative zone. For example, prominent
subcutaneous veins running upward on the lower chest wall in
the anterior axillary or nipple line are associated with abscess in
the right lobe near the upper and posterior surface.

6. Absence of jaundice will be taken into account, and in
no case of liver abscess will jaundice be noted as a sign. A
distinction must be made between the darkened sclera which
is always present, and the bile-stained conjunctiva which never
exists unless the abscess is complicated by an inflammation and
obstruction of the larger bile ducts, as in certain forms of
cholelithiasis. I have never seen the two conditions existing
simultaneously in the same patient, and in those cases of amœbic
abscess of the liver that have come under my observation jaun-
dice was not present, even in a mild degree, in a single case.

7. The absence of splenic enlargement is likewise a note-
worthy negative sign. It is a peculiar feature of this disease
that, notwithstanding the enormous enlargement of the liver
in those cases that come to us late in the course of treatment,

there is no enlargement of the spleen or tenderness over its area. This fact will aid in distinguishing between the disease under consideration and the various anæmiæ and malaria.

8. Friction sounds over the hepatic area are heard in some cases, but they will be present only when the pus accumulation in the liver or its surrounding inflammatory zone has reached the surface of the organ and involved the peritoneal layer; or the process, having gone on to a later stage, and adhesions having formed between the liver and diaphragm, the pleura also becomes involved with a plastic exudate on its diaphragmatic surface. This sign will, of necessity, be present only in those cases well advanced on the course of the disease, or in such cases in which the abscess occurs primarily near the capsule. Friction sounds on the under surface of the liver cannot be detected.

9. Bulging of the right lower chest wall is not apparent in a recent case, or in an old case of medium-sized pus collection. It is noticed only in those cases in which the abscess has reached enormous proportions, and where portal circulation is correspondingly increased. In these advanced cases bulging is noticeable on inspection, and I have seen the circumference of the right lower chest wall increased eight centimetres.

10. Cough, dry in character, is an accompaniment of pleural irritation, and is therefore not complained of by patients in whom the abscess is limited to the parenchyma of the liver. When present, it means that the inflammation has extended through the diaphragm to the pleura at some point. It is therefore an associated symptom with an inflammation that has extended through the capsule. Should the cough be accompanied by a bloody and purulent expectoration, the sputum should be investigated most carefully, and the possibility of abscess rupture into the substance of the lung must be taken into consideration. I have seen three cases in whom the diagnosis was delayed until pulmonary rupture had taken place. In two of these cases the diagnosis of amœbic abscess of the liver was established by the pathologist during the routine

sputum examination on their admission to the hospital with suspected pulmonary tuberculosis.

11. Localized œdema of the chest wall, or in the subcutaneous tissues below the rib margin, is never present in recent cases or in large abscesses without adhesions. In cases of long standing, where adhesions have taken place between all the various structures from the liver to the cutaneous surface, œdema in an intercostal space or at a point in the infracostal region is occasionally noticed, and means that pus has invaded all the intervening structures, and is an evidence of delayed diagnosis.

12. Basic pneumonia in the right lower lobe is a late complication of hepatic abscess, and is therefore not a condition met with in abscess of recent occurrence or of small size. It is a later stage of the condition which has led up to diaphragmatic adhesions and pleurisy, and will not be found unless the suppurative process has involved all the structures from the liver to the visceral reflection of pleura. It is the result of inflammation extending by contiguity.

13. Shortness of breath is also a symptom of the disease far advanced, *i.e.*, it exists only when the liver is enormously enlarged, or in those cases where adhesions have formed between the liver and diaphragm, or where a visceral pleuritis exists, or where a pus accumulation in the left lobe is encroaching upon the pericardium. In the earlier stages of liver abscess, and in small accumulations in the interior of one of the lobes, normal respiration is not disturbed.

14. Pain in the right shoulder, radiating to the side of the neck, gnawing and aching in character, named as a symptom by many writers, is a rare occurrence. It is complained of only by those patients in whom the abscess is located in the neighborhood of the base of the gall-bladder, as in the lobulus spigelii, or in the posterior and inferior border of the right lobe near the transverse fissure. As abscess in this location is not as common as abscesses in other parts of the right lobe, the shoulder symptom will be present in but few cases.

15. The skin is moist over the entire body, but I have never seen profuse perspiration in these cases excepting those in whom the abscess had reached large proportions and was on the verge of rupture. Examination of pus from these cases revealed a preponderance of cocci. The skin of the hands is moist like that of the rest of the body, but is rarely cold and clammy.

16. Disturbances of the digestive organs are not severe. The tongue has a characteristic coating of a grayish fur at the base and middle, with clear edges and tip. It is never dry, brown furred, and cracked, as is the tongue of enteric fever. Neither is it thick and indented, as is the tongue of malaria. Very few patients have nausea or vomiting, but anorexia is common, and flatulence is to be expected. The digestive disturbances are limited principally to those conditions dependent upon a previous dysenteric attack, such as constipation and flatulence, or to a concurrent dysentery with repeated evacuations.

17. The urine presents several peculiar features, one of which is that even in small abscesses of the pure amœbic type only, a slight trace of albumen is generally found. If, however, the abscess is a concurrent affection with dysentery, it is not unusual to find a limited number of hyaline and epithelial casts, together with a marked albumen deposit. I do not think, however, that their origin can be traceable to the condition of the liver, for albumen in small quantity, and casts in limited number, are found in nearly every case of dysentery returning from the Islands. The kidney condition more likely depends on the chronic intestinal ulceration, and not on the lesion in the liver.

18. Chills are a rare occurrence, and I have seen but two cases in whom rigors came on during the entire period of their invalidism with this affection. Both these cases had a fulminating streptococcus infection, and were seen late in the course of the disease, the abscesses having ruptured into the pleural cavity. A sense of chilliness is, however, an accompanying symptom in every case.

19. An anæmia of 1,000,000 or 1,500,000 of red blood-corpuscles is the rule, with 60 to 80 per cent. of hæmoglobin.

20. Pain or discomfort in swallowing is a symptom associated with pus collections in the left lobe,—a pressure symptom sometimes seen in multiple abscesses where the left lobe is greatly enlarged.

21. Stupor and delirium are absent except in fatal cases, as in the last stages of multiple abscess.

Stool examination, positive for amœba, is merely confirmatory. The absence of amœba in the fæces has no significance.

I may state here that the X-rays are of no benefit as a diagnostic means in small abscess in the interior of the organ, as they are obstructed in almost equal measure by the density of the liver substance and the pus collection, and the difference in the shadows cast is indefinable. Where the abscess has reached large proportions or encroaches on the capsule, the change in surface contour can sometimes be outlined with the fluoroscope, and this evidence will supplement the information given by percussion.

To recapitulate the features which characterize a typical liver abscess case seen early in the course of the disease: He gives a history of dysentery contracted in the tropics, and has lost weight; his features are drawn; his complexion is ashy-brown; he suffers with languor, and complains of a dragging pain in his liver; his liver dulness is increased on percussion and has an area of tenderness; his temperature rises in the evening to 100° F. (pure amœbic type) or to 102° F. (mixed infection), the corresponding morning temperature being 98° F. and 99° F.; his evening pulse is 95 (pure amœbic type) or 110 (mixed infection), the corresponding morning beats numbering 72 and 85. He has a leucocytosis of 12,500, 70 per cent. hæmoglobin, and 3,500,000 red blood cells by count; the subcutaneous veins over the hepatic area are dilated; he has no jaundice or splenic enlargement; there are no friction sounds over the hepatic area, nor is there bulging of the chest wall, or local œdema; cough is not a symptom; basic pneumonia is not present, and there is no dyspnœa; the skin is moist; the tongue is coated with a grayish fur, and he is either constipated

(postdysenteric) or has an active chronic dysentery; his urine shows a trace of albumen, and at times casts; he feels chilly but has no rigors; his brain is clear but inactive; he is generally an ambulatory case, but feels very much out of sorts, and is willing to resort to anything to be restored to health.

THE TREATMENT OF POSTERIOR PERFORATIONS OF THE FIXED PORTIONS OF THE DUODENUM.[1]

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RETROPERITONEAL perforations of the duodenum are of such infrequent occurrence that little attention has been directed towards their treatment. In fact, after as careful a study as my facilities afford, I have been unable to find anything written upon the subject which is at all satisfactory. During the past year Theodore Kocher has published in the *Zentralblatt für Chirurgie*, No. 2, a paper entitled " Mobilisierung des Duodenum und Gastroduodenostomie," in which he explains very fully from an anatomical and clinical standpoint how it is possible and even easy (in the absence of chronic inflammatory conditions involving the head of the pancreas, gall-ducts, stomach, and perhaps the neighboring under surface of the liver) to so free the descending as well as the lower flexure of the duodenum that, by rotating these mobilized parts towards the left, a gastroduodenostomy can be done with great ease,—the duodenum and stomach being lifted through the abdominal incision for the more proper carrying out of the technique.

Kocher was preceded in this operation, *i.e.,* " gastroduodenostomy," by Villard, Jaboulay, and Henle; but it does not appear from their writings that these surgeons fully comprehended the amount of mobility the duodenum was susceptible of *after* certain preparatory procedures. In passing, it may be noted that the intestinal end of the common bile duct has been exposed and attacked after the same preliminary freeing of the duodenum. Although it is not in my province

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[1] Read before the Western Surgical and Gynæcological Association, December 28, 1903.

at this time to discuss the advantages pro and con of gastro-
duodenostomy over other surgical methods, neither does the
surgery of the gall-tracts fall within the scope of my paper.

I have called attention to both in order that I may empha-
size a method which is anatomically and clinically applicable
in the treatment of retroperitoneal perforations of the duode-
num.   The parts involved must be susceptible of exposure
and rotation forward into the light of an abdominal incision.

Jeannel (Mikulicz, Kausch; *Handbuch der praktischen
Chirurgie*, Band iii, 1903) has recently collected out of the
literature thirty-five cases of injury to the duodenum.   Among
the subcutaneous perforating injuries he calls attention to the
comparative frequency of complete tearing off of the duode-
num; there were five cases,—three close behind the pylorus
and two at the juncture of the duodenum and jejunum.   This
is explained by the fact that at these two points a freely
movable part of the bowel joins a fixed portion.   The incom-
plete ruptures are found at the lower half of the duodenum.
Among twenty cases of incomplete rupture, the superior part
was involved two times; at the level of the papilla of Vater,
four times; below this, but still in the descending part, three
times; in the inferior portion seven times.   The site of the
lesion was found fourteen times through the anterior peri-
toneal bedecked surface and only six times through the pos-
terior wall.   In all of these cases, except one, the direction of
the rupture was at right angles with the long axis of the
bowel.   The length of the tears varied from the very smallest
to those involving two-thirds of the circumference.   In look-
ing up the subject of gunshot wounds of the duodenum I ran
across only one case, reported by Douglas in his recent book
upon " Abdominal Surgery;" this wound involved the first
part of the duodenum and was operated upon successfully.

According to Mikulicz (*Praktischen Chirurgie*, Band iii,
1903), no case of posterior perforation of the fixed portions
of the duodenum has been operated upon.   Cachovié (*Cen-
tralblatt für Chirurgie*, No. 25, 1903) refers to a paper written
by himself, " Ueber Fistulen des Duodenum," *Archiv für klin.*

Chirurgic. Band lxix, Heft 3, in which he discussed the methods of treating these fistulæ by duodenorrhaphy, gastro-enterostomy, and jejunostomy, especially calling attention to the necessity of closing the pylorus when a gastro-enterostomy is done in order to prevent the stomach contents passing into the duodenum, and in this way preventing a closure of the fistula. Cachovié reports a case operated on in July, 1902, in which, to control a circulus vitiosus, he closed the pylorus by a seromuscularis " tobacco-pouch" stitch, and likewise shut off, by the same stitch, that part of the jejunum between the gastro-enterostomy opening and that of an entero-anastomosis done four and one-half months previously. On post-mortem one and one-half months later it was found that the latter occlusion was complete, the former nearly so.

Should a contusion of the abdomen be followed by signs leading one to suspect a rupture of the duodenum, and in consequence an abdominal section be determined upon; or should a stab wound from behind or a gunshot wound from either in front or behind disclose upon section that the posterior fixed duodenum was opened, several things are to be considered in an attempt to repair the injury. First, the relations of the peritoneum in this locality; second, the size and direction of the blood-vessels. Huntington (" Anatomy of the Peritoneum and Abdomen") has shown very beautifully that in the development of the intestines and peritoneum how by rotation from left to right the duodenum becomes fixed, and only covered in front by peritoneum. The early peritoneal investment after rotation blending to the right with the parietal peritoneum, the mesoduodenal investment blending behind with the primitive parietal peritoneum.

By cutting perpendicularly through the peritoneum about three centimetres to the right of the descending portion of the duodenum and insinuating the finger behind towards the left, it is quite easy to reverse the original rotation. The descending portion of the duodenum and its lower flexure can be lifted out of the bed of loose cellular tissue formed by the fusion of the right mesoduodenum and the primitive

parietal peritoneum. This movement exposes the posterior surface of the duodenum and admits of its repair. Kocher (*Centralblatt für Chirurgie*, No. 2, 1903), "The relations of the blood-vessels determine the limit of the rotation and lifting forward of the bowel. The concave left-sided commencement of the duodenum is supplied with blood by the gastro-epiploica dextra, the chief branch of the gastroduodenalis. Important branches also go to the transverse colon over the inferior portion of the duodenum. These vessels lie under the upper layer of the gastrocolic ligament, and offer in themselves little hindrance to the lifting up of the inferior part of the duodenum from the spinal column.

"If the colon is raised, we see the colica dextra, the large branch of the superior mesenteric. The artery runs horizontally from left to right, and the branches pass down the duodenum to the lower and lateral circumference, and also to the right flexure of the colon. These vessels are not so easily lifted towards the left as those of the gastro-epiploica dextra, but nevertheless they do not prohibit the freeing of the inferior flexure of the duodenum to the extent but that the whole vertical portion or limb may be loosened and brought forward. The rotation is made with the hepatico-duodenal ligament above as a fixed point and a continuation downward of the left border of the duodenum over the head of the pancreas as an axis. The lower fixed point is determined by the location of the branches of the colica dextra which limit the rotation and lifting up of the inferior flexure and a portion of the lower duodenum."

My own work upon the cadaver convinces me that Kocher is right when he states that by this procedure no damage to blood-vessels is done, as the peritoneum is separated from in front of the right kidney, and between this and the beginning of the transverse colon and the loose cellular tissue in front of the vena cava and aorta.

One year ago I reported a case of hæmatoma which pressed from behind upon the descending duodenum and its lower angle. It caused complete obstruction of the bowel.

The tumor resulted from a contusion of the anterior abdominal wall, and could be palpated. Upon opening the abdomen, the peritoneum on the right side, *i.e.*, the primitive fused mesoduodenum and parietal peritoneum, appeared like a mesentery.

This was incised to evacuate a sufficient bulk of the clot to relieve the obstruction of the bowel. The exploring fingers could be passed freely behind the vertical portion of the duodenum.

Recently, a case of gunshot wound involving the anterior wall of the upper vertical portion of the duodenum and the posterior wall of the duodenum nearer the lower angle came under my care.

A young man, in attempting to escape from a policeman, was shot in the back by a 38-caliber Colt's revolver, the ball entering just below the twelfth rib and through the outer edge of the erector spinæ muscles, coming out in front one and one-half inches below the juncture of the ninth right costal cartilage and the right rectus muscle. One hour after the shooting the patient was etherized under customary hospital surroundings. The abdomen was opened by a vertical incision through the wound of exit. It was observed that the bullet had, in its course from behind forward, perforated the duodenum and gall-bladder. The wound in the anterior duodenal wall was sutured, likewise both holes in the gall-bladder.

Because of the bad condition of the patient, it was decided not to attempt to expose the posterior duodenal wall from in front, but rather to rely temporarily upon an incision from behind and the introduction of a gauze pack. In the carrying out of this latter procedure, I discovered, as expected, that the bullet had made a groove through the lower pole of the right kidney,— another reason for the posterior incision. A liberal gauze pack drain was introduced down to the repaired duodenal wound of exit and the wounds of the gall-bladder, and the abdomen closed so as to admit of drainage.

The patient died three days later, the post-mortem illustrating the cause of death to be a retroperitoneal phlegmonous

inflammation without peritonitis. Had the man's condition admitted, I would have sutured the wound in the posterior duodenal wall after freeing and rotating the duodenum to the left. In the light of to-day, one should in a like case, in addition to repairing the duodenal wound or wounds, occlude the pylorus by means of a purse-string stitch. Either at this same operation or as soon thereafter as reaction admitted, a gastroenterostomy must be made. None of the procedures which I have indicated require much time or handling of the intra-abdominal contents; they are the only rational methods of treating a perforation of the posterior wall of the duodenum. It is almost impossible for a gunshot wound of either the stomach or duodenum, which perforates both walls, to be limited to those organs; therefore, under such circumstances, in addition to the repair of any intraperitoneal organs involved, proper incisions must be made to provide for the retroperitoneal drainage. Wiart and Mikulicz recommend a somewhat similar line of procedure, although they have had no experience in the practice.

INTESTINAL OBSTRUCTION DUE TO FIBROUS STRICTURE CONSEQUENT UPON STRANGULATED HERNIA.

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WHEN the immediate dangers attendant upon strangulated hernia have been safely passed, it is rare for any trouble directly consequent upon the strangulation to arise at a later period. In a recent paper Bloodgood [1] has called attention to this fact, and quotes a large series of operations for all classes of hernia at the Johns Hopkins Hospital, numbering over 900, in which there was but one case of obstruction occurring in a patient who had recovered from the first operation. This case proved fatal, but no details are given. Considering the large number of recoveries from strangulated hernia, either after operation or after successful taxis, and the amount of damage which in many cases must have been sustained by the bowel during its incarceration, it is remarkable how few of the patients suffer at a later period from intestinal obstruction due to cicatrization.

Treves,[2] writing in 1899, stated that he had found, besides some specimens in museums, only eleven recorded cases of this condition. Most of these, together with some others, will be found tabulated at the end of this paper, in addition to three new cases which have come under my own observation. Two of these were in St. Thomas's Hospital, under the care of Mr. Clutton and Mr. Battle respectively, for whom I acted, and who have kindly allowed me to make use of them. The third was a private patient of Mr. F. C. Abbott, whom I assisted at the operation, and who has kindly placed his notes at my disposal.

The explanation of the rarity of this condition is, I think, to be found in the fact that the trouble is only likely to occur in

733

an uncommon class of hernia, namely, where the damage has
been too great to allow of perfect recovery, and yet not suffi-
cient to produce complete gangrene. When gangrene of the
whole thickness of the gut wall is found to have occurred, or
is considered likely to happen, it is treated either by invagi-
nation, resection, or enterostomy; or else, having been returned
into the abdomen, it brings about a fatal issue from peritonitis.

Stricture after strangulated hernia may therefore be re-
garded as a sequela of those " doubtful" cases which are for-
tunate enough to escape perforation after reduction.

Although the condition of the gut is by no means depen-
dent upon the duration of strangulation, it is of some interest
to observe that in those cases in which it has been noted the time
has varied from fourteen to seventy-two hours, the average
being fifty-five.

In the series under consideration, whilst there has usually
been some additional factor in the production of the obstruc-
tion, such as adhesions or kinking, there has in all been a struc-
tural change in the bowel wall primarily, and I have excluded
cases where the adhesion, kink, or other accident was the sole
cause.

Pathology.—In most cases the stricture has been single and
extensive; in the minority there have been two annular con-
strictions at a short distance apart, with a pouch of non-
cicatrized gut between them.   We may therefore distinguish
two kinds, each having a distinct mode of production.

(1) The single stricture.   From experiments on animals,
carried out by placing clamps at varying pressures upon the
mesentery, Maas[3] found that when only the venous circula-
tion in a portion of the bowel is interfered with, the resulting
congestion passes off after removal of the clamp, and leaves no
structural change.   If, on the other hand, the arterial supply
also is interfered with, then one of two events follows, (*a*) if
only for a short period, necrosis of the inner coats occurs, com-
mencing in the mucous membrane, and commensurate in depth
with the duration of the ischæmia; (*b*) beyond a certain period
of time total gangrene results.

The single stricture, whether involving the whole circumference of the bowel or not, follows upon necrosis due to temporary interference with the arterial supply of the loop. In Bryant's [4] case, for example, the cicatricial area was an inch and a half long, "as though the whole loop had suffered." This might easily result from the strangulation of a small knuckle, such as is so often found in a femoral hernia. Belonging to this class are the cases of Mollard,[5] Maas,[3] Newton Pitt,[7] Goodhart,[8] Obre,[9] and Nicaise.[10]

(2) The double stricture. This is produced in an entirely different manner, being dependent upon cicatrization resulting from direct local damage at the site of strangulation. In the cases which I have had the opportunity of examining, it was obvious that the mucous membrane, as well as the other coats, had suffered. In all the peritoneum looked white and thickened at the site of the cicatricial ring. But it is of interest to note here a case recorded by Allaux,[11] in 1860, in which the mucous membrane was normal and moved freely over the stricture which involved only the outer coats. In this instance there are no clinical details, as the patient when first seen was moribund from peritonitis, and died almost immediately. At the autopsy a portion of bowel was found, a little distance above the ileocæcal valve, which had been involved in a femoral hernia. There were four annular constrictions, a few centimetres apart, with dilated pouches between them. No history of previous strangulation was given, and Allaux attributed these rings to the pressure of an ill-fitting truss.

The annular stricture is the less common variety, and for this reason, that damage sufficient to produce any considerable degree of cicatrization would rarely be arrested at this point, but would either lead to extensive necrosis with subsequent perforation, or would guide the surgeon to anticipate such a calamity by resection or some other means.

The instances of this variety of stricture are those of Alexis Thomson,[12] Raoult,[13] Bernard Pitts,[14] and the three which are here given in detail. I have classed Abbott's case under this heading, although only one stricture was found. It was annu-

lar, narrow in vertical extent, and had evidently been produced in the same manner as the others.

No doubt the two varieties are sometimes present together, for in the cases of Garré and Maas well-marked constriction grooves were noted at the herniotomy. In many cases where such lines of constriction have been observed, the resulting cicatrization must be too slight to be a subsequent source of danger unless some additional factor be added.

Whether the stricture is of the first or the second variety, obstruction may be brought about in any of the following ways:

1. The actual lumen may become progressively narrowed so as to cause symptoms of varying severity.

2. Indigestible substances may become impacted above the stricture. In one instance a mass of beans and raisin seeds was found; [10] in another, a number of orange pips and currants.

3. Adhesions to the parietes or to neighboring viscera (the bladder in one case [3]) will add to the dangers of obstruction.

4. Adhesion between the gut above and below the stricture, and the formation of a spur. In the case recorded by Nicaise this had occurred in such a manner as to mimic the ileocolic junction. The dilated pouch above resembled the cæcum, and the strictured part projecting into its lumen, the ileocæcal valve.

5. A sudden kink at the site of constriction may occur independently of adhesions.

Variety of Hernia and Portion of Bowel involved.—Both inguinal and femoral strangulations have preceded the obstruction, the inguinal rather more commonly than the femoral; but I have been unable to find an instance following any other variety. Goodhart's case, in which the structured gut was found, post-mortem, occupying an obturator hernia, was the result of a femoral strangulation five years previously.

As regards the portion of bowel involved, all the instances have occurred in the small intestine, no example of stricture of the colon from this cause having, so far as I am aware, been recorded. This fact goes hand in hand with the preceding, since the colon is comparatively rarely strangulated, and then it

is most frequently found in an umbilical or a ventral rupture. Most of the instances have occurred in the ileum, but some in the jejunum. In one example it was only two feet below the duodenum,[12] in another six, and in a third nine.[10]

Course of the Symptoms.—Any interval may elapse between the strangulation and the commencement of the resulting obstructive symptoms. It has varied from a week up to eighteen years. In the majority of instances the symptoms have either been of a chronic nature throughout, or chronic terminating acutely. These have been marked by spurious diarrhœa, frequent vomiting, abdominal distention, and progressive emaciation. In very few has a sudden acute obstruction occurred without previous symptoms. Such cases would most probably be due to a sudden acute kink at the site of constriction, a condition which was actually present in one of my cases. One or two have been marked by excessive diarrhœa shortly after the herniotomy, pointing to ulceration of the mucous membrane.

Treatment.—This must of course depend upon the condition found at the operation. Undoubtedly the ideal treatment is to widen the lumen by dividing the stricture in the long axis of the bowel and suturing the resulting wound in the transverse diameter, but the cases in which this would be possible are rare. On the analogy of pyloroplasty, the name enteroplasty has been applied to this operation, although the conditions are not precisely similar. The successful cases of Mollard and of Abbott were dealt with in this manner, and Allingham [15] has given two successful cases in which the operation was done for simple stricture of the intestine due to other causes. It is well, however, to bear in mind the possibility of a kink occurring at the mesenteric border after the suturing is completed, and the consequent formation of a spur at that spot.

Where two strictures occur at a distance from one another, or where the stenosis is too extensive, or too complicated by adhesions for enteroplasty to be done, then lateral anastomosis would be the best treatment. In one case, indeed, it looked as though nature had indicated this line of treatment, for adhesions

24

had occurred, followed by ulceration, between the bowel above and below the obstruction, thus producing what one might almost look upon as a natural lateral anastomosis. In cases of acute obstruction, however, the conditions of vitality of the gut wall and the virulence of its contents would militate against success in this as in other forms of acute intestinal obstruction. In my first case death was due to purulent peritonitis, although the lateral anastomosis had not leaked. I attribute this to the virulence of the intestinal contents, and believe that the right way to have dealt with the case would have been to relieve the obstruction by enterostomy, and to have done the anastomosis after the bowel had resumed its normal condition. Alexis Thomson suggests lateral anastomosis, but prefers resection. Both his cases treated in this manner recovered, as also did those related by Garré and Maas. Considering the innocent nature of the stricture, however, this would appear to be an unnecessarily severe procedure, especially if extensive adhesions are present, unless called for by perforation, actual (as occurred in two cases) or threatened.

CASE I.—A male, aged forty-eight years, was admitted to St. Thomas's Hospital on March 30, 1903, under the care of Mr. Battle, suffering from acute intestinal obstruction of three days' duration. There was a short scar over the right iliac fossa, the site of what, from the history, had been an appendicular abscess opened thirty years previously. He gave a history of having had a strangulated hernia reduced under chloroform eighteen years before. He did not remember how long the symptoms had lasted before the reduction. There was a partially reducible left inguinal hernia, quite slack, and having an impulse on coughing. It was thought that the obstruction might be due to adhesions consequent upon the abscess thirty years previously. The abdomen was opened in the mid-line below the umbilicus. Distended small intestine presented. On following this downward the cause of the obstruction was found situated in the ileum about three feet above the ileocæcal valve. There were two annular fibrous constrictions two inches apart, the portion of bowel between them being dilated to form a pouch. There were no adhesions involving

this portion of the intestine. Both constrictions were pervious, but the lumen was occluded by an acute kink at the site of one of them. A lateral anastomosis was effected between the portions of intestine above and below the obstruction. On the third day the bowels were opened. Unfortunately, death occurred from peritonitis on the fourth day. At the autopsy the anastomosis was found to be water-tight, so that the peritonitis must have been due to operation infection. The left inguinal canal was occupied by a process of omentum. There were many old tough adhesions in the right iliac fossa and between the liver and parietes.

CASE II.—A female, aged forty-one years, was admitted to St. Thomas's Hospital, under the care of Mr. Clutton, on October 30, 1903, with symptoms of acute intestinal obstruction of two days' duration. There were signs of free fluid in the peritoneal cavity, and the liver dulness was absent in front. Five months previously she had been operated upon for a left femoral hernia which had been strangulated for thirty-six hours. In the light of the previous case, it seemed probable that obstruction and perforation had occurred at the site of the previous strangulation, and this turned out to be the case. The abdomen was opened through the left rectus. Feculent fluid and gas escaped. Adherent to the neighborhood of the left femoral ring was a coil of small intestine which had perforated. The patient's condition was so bad that nothing radical could be attempted. The offending coil was therefore brought outside the abdomen, the peritoneum cleansed as thoroughly as possible, and the wound partially closed. Death took place a few hours later. For the pathological description I am indebted to Dr. C. R. Box, who performed the autopsy.

" Six feet below the duodenojejunal flexure was a perforated coil of small intestine. The gut in this situation was doubly strictured as if it had been nipped in a hernia. Above the upper stricture there was a pouch, and in the pouch was an extensive ulcer. Below the stricture was another pouch and then the second stricture. Lodged in the pouches were some orange pips and currant skins. The kinked bowel had become adherent to itself in such a manner that the part above the upper stricture was adherent to the part immediately below the lower one, and a fistulous communication had been thus established from the ulcer to the gut below the lower constriction. The adhesions tunnelled

by the fistula had perforated, and in addition the ulcer had perforated on the opposite wall of the bowel. The ulcer was chronic, and the gut above the obstruction was dilated and thickened. The normal lumen, though present, was very tortuous at the obstructed part."

CASE III.—Mr. Abbott's Case.—The patient was a gentleman aged seventy years, who had led an active and healthy life. He had suffered from a left inguinal hernia for twenty years, which had given him trouble from time to time, and for which he had always worn a truss. Three months before operation he had over-exerted himself by carrying a portmanteau, and on the next evening was seized with colicky pain, which rapidly became worse. The abdomen was hard and tender, especially in the left lower part. He became cold and collapsed and vomited. The pain was relieved by morphia and fomentations, but the vomiting continued, ultimately becoming black. On the second evening after the attack he passed a stool containing much dark blood, and in a few days he recovered completely. He did not recall the condition of the hernia at the time, but this attack was in all probability due to the strangulation of a piece of bowel which luckily freed itself. During the following three months he had four severe attacks of abdominal pain, with constipation and vomiting, and for the whole of that period he had suffered from troublesome and unaccustomed constipation. On examination, there was a moderate-sized, easily reducible left inguinal hernia. The abdomen appeared absolutely normal.

Operation.—The abdomen was opened through the left rectus. A ring stricture was found in the ileum two and a half feet above the ileocæcal valve. At this point the bowel was markedly contracted, the peritoneum was dull white and thickened, and the wall of the gut felt thickened. On opening the bowel by a longitudinal incision above the stricture there was seen to be a tight fibrous ring having a lumen the size of a cedar pencil. No trace of a second stricture could be found. The incision was then carried downward through the stricture, and the wound was sutured in a transverse direction. There seemed to be a slight kink at the mesenteric border, but the lumen was perfectly free. The abdominal wound was closed in layers. There was a severe and prolonged attack of colic on the second day, accompanied by visible peristalsis, which was believed to be due to obstruction caused by

the kink and swelling at the line of suture. The attack was relieved by morphia and a turpentine enema, and there was no further trouble of any kind. Mr. Abbott writes: " I believe that the first attack was due to the strangulation of the hernia, and that the subsequent ones were caused by the commencement and increase of the stricture. Owing to the small transverse length of the fibrous ring when opened out, a kink was produced at the mesenteric side when the enteroplasty was completed. For this reason I believe that an anastomosis would have been the better operation, and is the course I should adopt in a similar case."

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[16] Quoted by Thomson.
[17] Quoted by N. Pitt.
[18] St. Thomas's Hospital Reports, 1890.

TABLE OF RECORDED CASES.

No.	Author.	Sex.	Age.	Kind of Hernia.	Duration of Strangulation.	Interval.	Portion of Bowel involved.	Pathological Condition found.	Character of Symptoms.	Treatment.	Result.
1	Bryant[4]	F.	52	Femoral.	30 hours.	7 weeks.	Ileum.	Single stricture.	Chronic.	No operation.	D.
2	N. Pitt[7]	F.		Femoral.		5 days.	4 feet from cæcum.	Single stricture; perforation.	Chronic.	No operation.	D.
3	Obre[9]	F.	34	Direct inguinal.	3 days.	7 months.	1 foot from cæcum.	Single stricture; adhesions.	Chronic.	No operation.	D.
4	Garré[6]	M.	27	Inguinal.	14 hours.	5 weeks.	Ileum.	Single stricture; adhesions.	Chronic.	Resection and axial anastomosis.	C.
5	Maas[3]	F.	47	Inguinal.	24 hours.	16 days.	Ileum.	Single stricture; adhesions.	Subacute.	Resection and anastomosis.	C.
6	Thomson[12]	M.	31	Inguinal.	3 days.	3 weeks.	Ileum.	Double stricture.	Chronic.	Resection and axial anastomosis.	C.
7	Thomson[12]	M.	2	Inguinal.		5 months.	2 feet below duodenum.	Double stricture.	Acute.	Enterostomy. Subsequent resection and anastomosis.	C.
8	Caird[16]			Femoral.		7 months.	3 feet from cæcum.	Double stricture.	Acute.	No operation.	D.
9	Ritoult[15]	M.	54	Inguinal.		"Some years."					D.
10	Mollard and Bernay[5]	F.	44	Femoral.	80 hours.	6 months.	Ileum.	Single stricture; adhesions.	Acute.	Enteroplasty.	C.
11	Nicaise[10]	M.	45	Inguinal.		5 years.	9 feet below duodenum.	Single stricture; kinking.	Chronic.	Enterostomy.	D.
12	Fagge[17]					2 months.	2 feet from cæcum.	Single stricture; kinking.	Chronic.	No operation.	D.
13	Goodhart[8]					5 years.		Single stricture; kinking.	Chronic.	No operation.	D.
14	S. Jones[18]	F.	49	Inguinal.	4 days.	3 weeks.	Ileum.	Single stricture; kink.	Subacute.	Enterostomy.	D.
15	B. Pitt[14]	F.	27			3 years.	Ileum.	Double annular stricture.	Chronic.	Lateral anastomosis.	C.
16	Abbott	M.	70	Inguinal.		3 months.	2½ feet from cæcum.	Single annular stricture.	Recurrent subacute attacks.	Enteroplasty.	C.
17	Sargent	M.	48	Inguinal.		18 years.	3 feet from cæcum.	Double annular stricture with kink.	Acute.	Lateral anastomosis.	D.
18	Sargent	F.	41	Femoral.	36 hours.	5 months.	6 feet below duodenum.	Double stricture with kink; perforation.	Acute.	Enterostomy.	D.

PAPILLOMA OF THE RENAL PELVIS WITH MASSIVE HYDRONEPHROSIS.

BY HARRY B. REYNOLDS, M.D.,

OF SAN FRANCISCO.

THE report of the present case is justified by the size of the hydronephrosis and the rarity of papillomata of the renal pelvis.

The patient presented himself to the out-patient service of the San Francisco Polyclinic complaining of massive enlargement of the abdomen. He was referred to our wards at the city and county hospital, where the following history was taken:

H. C., male; aged sixty-six years; widower; born in Ireland; laborer.

Family history, negative. Previous history, negative; denies syphilis, and there is no subjective evidence of the disease. Had a bubo and chancroids forty years ago. Moderate drinker.

Present illness. About a year ago he first noticed distress after eating, with eructations of gas. Soon thereafter he began to have frequent urination, which was rather spasmodic than constant. Often he would urinate several times in a night, and at times would fill a chamber vessel before morning. At other times urination was of normal frequency. About nine months ago he first observed an increase in the size of his abdomen. It gradually but constantly enlarged until it attained its present proportions. Since the appearance of the tumor he has on several occasions passed dark-colored urine. These attacks lasted hours or days and were not accompanied by other urinary signs. For months he has been gradually losing flesh. He is considerably lighter, and thinks the presence of the tumor accounts for the fact that he has not lost more weight. His strength has diminished, but not excessively. Appetite good. Bowels constipated. At no time has he suffered pain.

Physical examination, December 1, 1903. Man of medium frame, poorly nourished. Appearance of a man thin by nature.

743

Not cachectic, but somewhat resembling a patient with a large ovarian tumor. Skin greasy and pale. Mucous membranes pale. Tongue coated with a brownish-yellow layer. Lungs hyper-resonant. Heart apex in fourth interspace in mid-clavicular line. Sounds clear but not forcible. Pulse 80, slight tension, regular in rhythm. Some sclerosis.

Abdomen. Distended to the extent of an abdomen pregnant at term. (Figs. 1 and 2.) Wall thin and tense. Umbilicus pro-tuberant. Left side seems fuller than the right. Palpation shows a large, tense, rounded mass filling the whole abdomen, extending upward beneath the left costal border and into the left flank and passing downward below the pelvic brim and well over into the right side of the belly. It is tense, smooth, movable, apparently thin walled, and transmits a fluid wave with great delicacy. Just above the symphysis there is a small, oval irregularity like an attached loop of bowel or mass of omentum. Percussion gives dulness extending down from the left costal border continuous with the liver dulness, reaching without interruption to the back, well down to the left ligament of Poupart, and a variable distance to the right of the median line. Tympany in the right flank in all positions. Across the summit of the cyst is a ridge or band coursing over from the right and above the umbilicus, thence across and downward about eight centimetres from the navel out-ward towards the left ilium, thence down into the pelvis. It gave the feel and peristaltic wave of gut, and on inflation proved to be the colon. Greatest circumference of abdomen ninety-nine centi-metres.

Extremities thin and flabby; glands in both axillæ; multiple, small nodules without periadenitis, and all of about the same size. Scrotum long and pendulous. Moderate double varicocele. A small, hard, movable mass is to be noted in the left cord.

Urine. The quantity of daily urine at no time showed any variation from the normal. After the first examination of the abdomen, with the accompanying manipulation of the tumor, blood was passed for about thirty-six hours, but then cleared up. Some days later bloody urine was again passed, the amount being decided. After the first hæmaturia had ceased, a specimen exam-ined was pale yellow, clear, 1020, no albumen, no sugar, no casts. The bloody urine showed no fresh red cells, but degenerated reds and leucocytes.
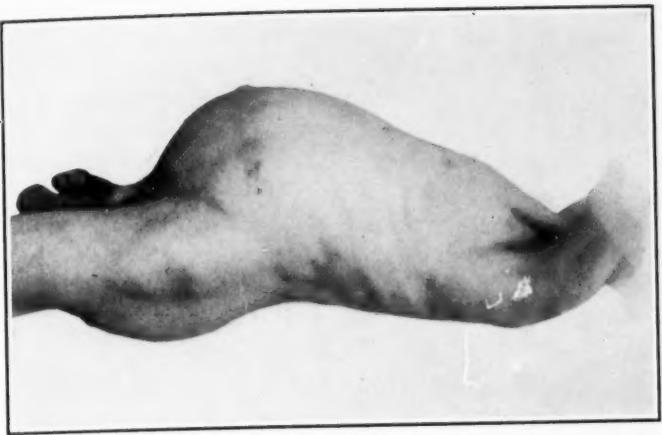
Fig. 1.—Showing abdominal protrusion caused by hydronephrosis.
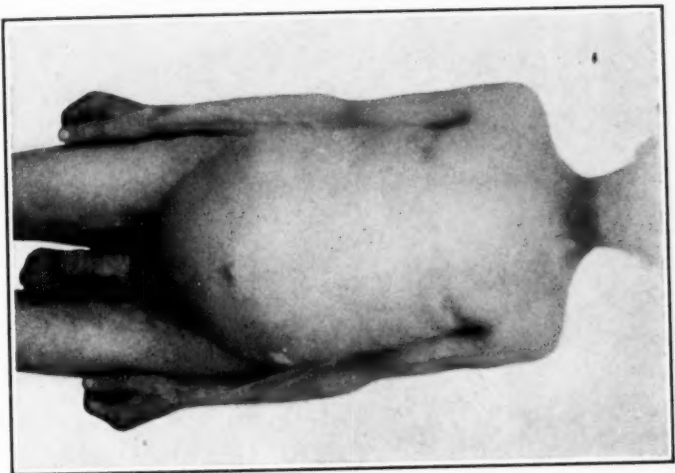

Fig. 2.—Anterior aspect of abdomen distended by hydronephrotic sac.

Blood examination, December 3, 1903. Red cells, 4,300,000; white cells, 13,000; hæmoglobin, 55 per cent.; polymorphonuclears, 83 per cent.; large lymphocytes, 10 per cent.; small lymphocytes, 7 per cent.

A second examination three weeks later gave, Red cells, 4,200,000; white cells, 6000; hæmoglobin, 41 per cent. Cystoscopy was ineffectual because of hæmorrhage from the bladder, probably due to varicosities at the vesical neck.

Urinary segregation by the improved Cathelin instrument was not practicable because of the pressure of the tumor, which prevented normal distention of the bladder.

The cyst was tapped in the left flank by the exploring needle. The needle entered a single large cavity. The fluid withdrawn was a dark, reddish-black, opaque fluid flowing easily through the needle. A sediment soon settled consisting of broken-down red and white blood-cells. No tumor cells were found. Traces of urea were detected. The dark fluid above the sediment contained albumen and paralbumin.

In considering the diagnosis, pancreatic cyst, mesenteric cyst, suprarenal tumor, and perinephric cyst were considered, but excluded. The position of the mass, dulness in the flanks, position of the colon, all indicated a retroperitoneal cyst. The urinary findings pointed strongly to the kidney. The size, presence of blood in the urine, periodic polyuria, and presence of urea in the aspirated fluid pointed strongly to hydronephroma. The cause of obstruction was obscure. Stone was eliminated by the absence of pain. The prostate was not enlarged, and there was no palpable tumor on rectal examination. Thus the possibilities were considered to be (1) papilloma of renal pelvis obstructing the ureter, and (2) malignant tumor causing pressure on the ureter and bleeding into the resulting hydronephrotic sac. Of these tumors, sarcoma was least probable because of the age. There was little ground for choosing between hypernephroma and carcinoma, but the greater frequence of the latter (30 per cent. of all kidney tumors of adults as against 17 per cent. of hypernephromas) as well as the age of the patient cast the probabilities on the side of carcinoma. A closer diagnosis was considered unwarrantable, and the patient came to operation with a tentative diagnosis of (1) papilloma of renal pelvis, or (2) carcinoma or hypernephroma of the kidney.

Operation, January 10, 1904; chloroform. An incision fifteen centimetres long was made two centimetres above ilium in such a direction as to be easily enlarged into the usual oblique nephrectomy wound. The cyst was punctured and fourteen pints of dark syrupy fluid removed. The cyst being collapsed and palpation showing no evident malignant mass or glandular enlargement, I decided on radical operation. The wound was therefore enlarged and the cyst removed. The wall was firmly adherent throughout and separation was tedious and progressed inch by inch. The outer layer of mesocolon, the large gut itself, and then the vascular mesocolon layer were in turn separated. The pedicle was ligated in mass. The ureter found, ligated, cut, and cauterized. No kidney tissue could be found. The peritoneal cavity was opened once by accident, but the rent was immediately closed. Hæmorrhage was slight and easily controlled. A Mikulicz tampon was inserted into the cavity and the ends of the wound closed around the gauze. The operation lasted two hours and twenty minutes. He was returned to the ward in fair condition, pulse of 100, soft and compressible. The patient passed sixteen ounces of urine the first twenty-four hours. For two days he continued to do unexpectedly well. Temperature, 100°–101° F.; pulse about 100. No pain, mind clear, considerable serous oozing but no hæmorrhage from the wound. On the third day, however, he began to develop a hypostatic congestion, which was obstinate to energetic treatment, and resulted in death on the fifth day. The pneumonia was not infectious, but purely hypostatic and due to the weakened circulation, the direct result of a severe operation in a patient nearly seventy years old, of low vitality, and with marked hydræmic blood (hæmoglobin, 42 per cent.).

Autopsy showed the other kidney normal, the wound and cavity in good condition, no metastatic glands, and marked hypostatic pneumonia.

The cyst was a large hydronephrotic sac with no tissue showing kidney structure. The tumor found was a papilloma the size of a small tomato situated just above the ureteric orifice and blocking its entrance by tumor masses. The microscope verified the diagnosis.

Tumors of this description are exceedingly rare. Albarran and Imbert, in their exhaustive study of renal tumors pub-

lished in 1903, have been able to collect but twenty-two cases, though their researches and reviews are exhaustive and extend over a period of years. The histories are typical,—progressive hydronephrosis, occasional bloody urine and polyuria, entire and characteristic absence of pain except for occasional mild colic from the passage of clots or tumor bits through the ureter.

Treatment is nephrectomy. Indicated by the progressive anæmia caused by the bleeding, liability to malignancy, and impossibility of diagnosing from malignant tumors.

THE RÖNTGEN-RAY DIAGNOSIS OF RENAL CALCULUS.

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THE development of the Röntgen technique marks the introduction of an exact method in the diagnosis of renal calculus. Formerly the diagnosis was made from the symptoms, pain and hæmorrhage, and confirmed or disproved by exploratory nephrotomy. The uncertainty of a diagnosis based upon symptoms is well illustrated by the experience of Henry Morris,[1] who reports forty-four nephrotomies for suspected stone in which no stone was found. It is well known that the symptoms, pain, hæmorrhage, pyuria, albuminuria, etc., belong to many other pathological conditions that may be present in the genitourinary tract. When a stone is the cause of these symptoms, they arise as a result of the *functional disturbance or pathological changes* usually the result of infection in the kidney or ureter induced by the presence of a calculus and not by the stone *per se*. Since calculous formations give rise to symptoms only after pathological conditions have been brought about in the kidney, and since these changes bear no constant relation to the symptoms they produce, it often happens that extensive damage has been done to the kidney tissue before a symptomatic diagnosis can be made. Furthermore, the size and character of the stone bear no constant relation to the severity of the symptoms produced.

In 1899, Abbé[2] collected from the literature and tabulated twenty-five cases in which a positive diagnosis had been made by the X-ray and later confirmed by operation. To this list of twenty-five he added two cases of his own, making twenty-seven cases reported to that time. These twenty-seven cases are arranged by years as follows:

748

1896. McIntyr, of Glasgow, reported the first skiagraph of a stone taken in the body. Swain, of Bristol, reported a case.

1897. Gürl, Nüremberg; Fenwick, England; Thyne, Australia.

1898. Bevan, Chicago; McArthur, Chicago; Lauenstein, Germany; Alsburg, Germany; Martin, England; Taylor, England; Fenwick, England; Leonard, Philadelphia, eight cases; McBurney, New York; Abbé, New York, two cases.

1899. Wagner, Germany, two cases.

The percentage of error in the positive diagnosis of renal calculus by the Röntgen method is still undetermined, because of the variations in the methods used, the skill of the operators, and the differences in the patients whose cases have been reported. In 1898,[3] Lauenstein pointed out that up to that time only oxalate stones were thought to show, and cited a case in which a definite shadow of a stone consisting of calcium carbonate, chiefly with some calcium oxalate and uric acid, was obtained. In 1899,[4] Ringel, as a result of his work, laid down the following propositions:

1. By the Röntgen procedure only the rather infrequent oxalate stone shows with certainty.

2. The showing of other kinds of kidney stones which are more permeable for Röntgen rays succeeds only under certain favorable conditions, such as the presence of a very large stone or the presence of a very permeable patient.

3. The Röntgen ray is to be employed in every case of kidney stone as a means of diagnosis. Reliance is to be placed, however, only upon a positive result, while, from the failure to obtain a kidney stone shadow, the absence of a kidney stone should not be concluded.

Leonard,[5] in 1900 and 1901, reports the development of a technique by which he was enabled in the examination of 136 cases to positively diagnose kidney stone in 100, with a known error in but one case, and error of 1 per cent. He does not describe his technique beyond stating that he uses a self-regu-

lating tube of rather low vacuum with a large volume of X-rays. He [6] lays down the dictum that " Accuracy in the negative diagnosis can only be assured by the development of a technique capable of producing negatives in which a differentiation can be made between shadows of tissues less dense than the least dense calculus."

In a later report of 300 cases examined,[7] Leonard found calculi in 86, 28 per cent. Of these 86 cases 50 per cent. were in the ureter. In five of the 300 cases no stone was found at operation, though diagnosed positively by the X-ray. He gives no report as to the number of his positive diagnoses which later came to operation. Of those that *were* operated no stone was found in five cases. In all probability a large number of the cases diagnosed positively were not operated, and of these we do not know how many would have proven negative at operation. He concludes that " a negative diagnosis is as accurate as the positive," and that " operation is contraindicated when no shadow is shown by the X-ray unless some other pathological condition is present."

Kümmel and Rumpel [8] report a series of eighteen cases diagnosed positively by the X-ray, all of which were subsequently operated and stone extracted. The conclusions drawn from their work are as follows:

1. The exact diagnosis of kidney stone is to be made only by means of the Röntgen procedure.

2. The presence of a kidney stone, whether located in the kidney substance, the calices, or in the ureter, will be demonstrated upon the plate in every case by proper application of the Röntgen method.

3. The negative result of the Röntgen method after repeated attempts allows the exclusion of a calculus.

4. The demonstration of a stone shadow upon the Röntgen plate is not dependent upon the size and chemical composition of the calculus, but singly and alone upon the technique of the Röntgen operator.

5. A high degree of corpulence in the patient may render the demonstration of a calculus by the Röntgen method very difficult, but in general does not render it impossible.

6. In every case of nephrolithiasis it is advisable to employ the functional methods of investigation, since they show us by combined application (*a*) whether a disturbance of the whole kidney function exists or not, (*b*) whether we have to deal with a double-sided stone formation or other co-existing kidney disorder, or whether in the already existing disorder only one kidney is involved.

7. The result of the negative Röntgen investigation should be considered in connection with the condition of the clearness, concentration, and freezing-point of the urine obtained by means of the ureteral catheter.

In the eighteen cases tabulated by Rumpel,[9] two of the stones removed contained only triple phosphates. All the others consisted of mixtures in different proportions of calcium carbonate, calcium phosphate, calcium oxalate, and uric acid or urates. Five of the stones consisted largely of calcium oxalate, fourteen of calcium phosphate, and two of uric acid. Of the two stones consisting largely of uric acid, the composition of the first was a mixture of uric acid with calcium phosphate, and of the second a mixture of uric acid with calcium oxalate and calcium phosphate.

In twenty-seven cases of suspected kidney stone operated upon by Bevan at the Presbyterian Hospital during the last two and a half years, in which the writer has had the opportunity to employ the X-ray as a means of diagnosis, it has been possible to make a positive diagnosis of calculus in thirteen cases, a doubtful diagnosis in one case, and a negative diagnosis in thirteen cases. In the doubtful case operation revealed a single, thin, flat, oxalate stone the size and shape of a pumpkin seed lying well up under the last rib. More careful examination of the skiagraph in this case showed a rather vague shadow directly over the last rib. The failure was due perhaps more to an error in the interpretation of the skiagraph than to the skiagraph itself.

In the thirteen cases in which a negative diagnosis was made, the following conditions were found at operation: Tuberculosis, five cases; pyonephrosis, two cases; essential

renal hæmorrhage, two cases; cystonephrosis, one case; hydronephrosis, one case; polycystic kidney, one case; hypernephroma, one case.

The technique of the Röntgen method has been developed by the contributions of many workers both in this country and in Europe. Drs. O. Rumpel and Albers-Schönberg, of Germany, deserve special mention for having done much to develop the technique of the application of the Röntgen ray in the diagnosis of renal calculi. The essentials in the technique of skiagraphy as applied to the diagnosis of kidney stone may be briefly stated as follows:

The apparatus required consists of a coil capable of giving a heavy spark from ten to twenty inches in length; a tube with an adjustable vacuum capable of carrying a heavy secondary discharge from the coil and having a comparatively low vacuum; fresh plates thickly coated to secure the largest degree of absorption of the rays.

O. Rumpel [10] has pointed out the necessity of using soft tubes to secure the greatest possible degree of differentiation. He recommends " the longest possible exposure with the softest possible tube." The developer used must be one that permits long development with a minimum degree of fog. Glycin and edinol are to be especially recommended.

The patient to be examined should be given a cathartic some hours before the exposure is to be made, and he should also refrain from eating solid food for a few hours in order that the gastro-intestinal tract may be as empty as possible. Eppinger [11] has recommended dilating the colon when it is desired to examine the right kidney or the stomach if a skiagraph of the left kidney is desired. He states that by this dilatation the overlying omentum and intestines are pushed aside and an airspace interposed, thus making possible a more definite outline of the kidney region.

The patient having been prepared upon the table as shown in Fig. 1, a skiagraph is taken which includes the entire area from the pelvis to and including the last two ribs. The tube is enclosed in a tube-sheath which rests upon a wooden disk faced
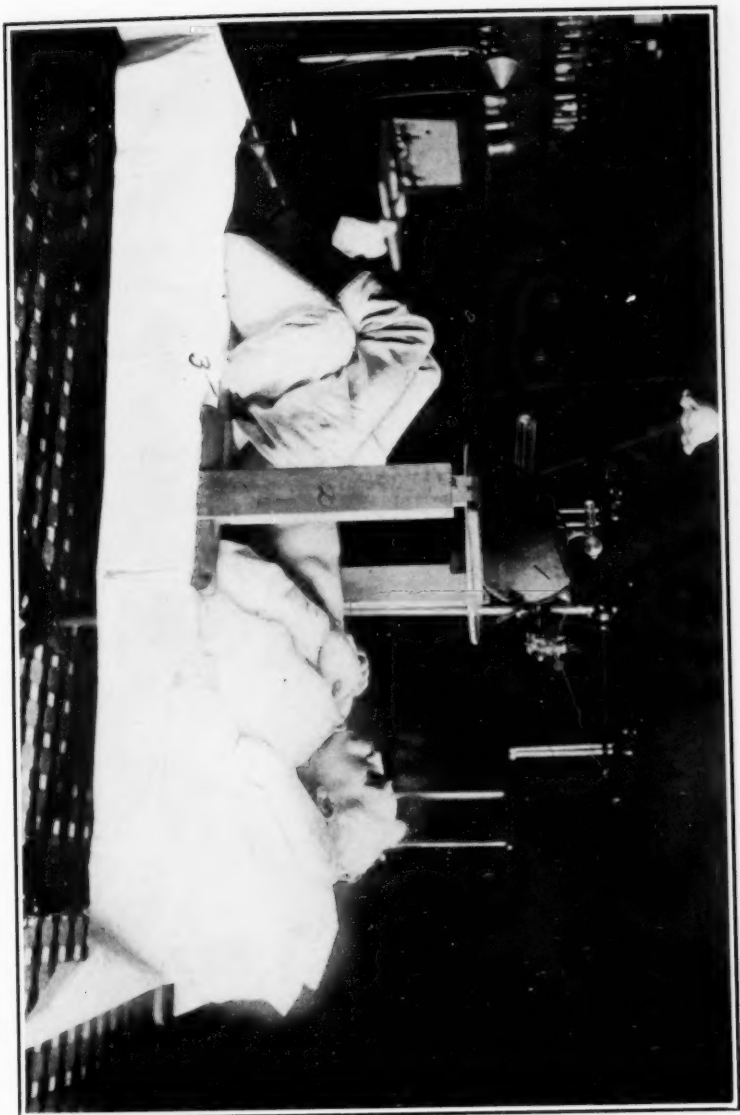
FIG. 1.—Apparatus arranged for taking a skiagraph of entire kidney region. 1. Tube in tube-holder. 2. Stand with circular top faced with lead plate one-sixteenth of an inch thick, having an opening three inches in diameter. 3. Steel plate one-eighth of an inch thick supporting sensitive plate.
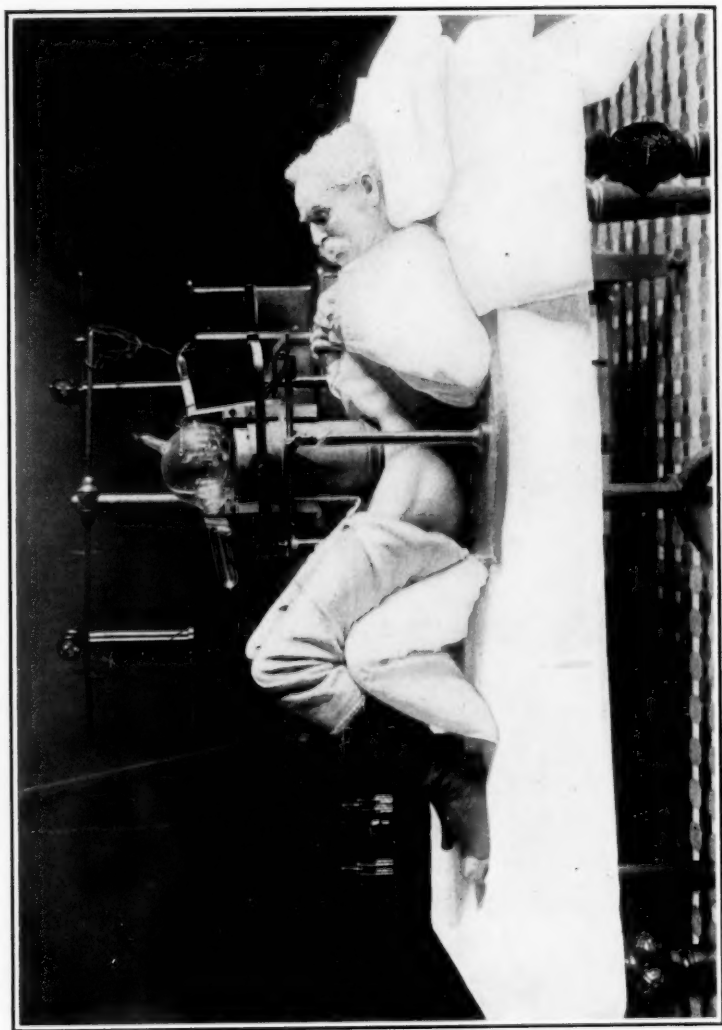
Fig. 7.—Lead cylinder apparatus of Albers-Schönberg.

Left

Right
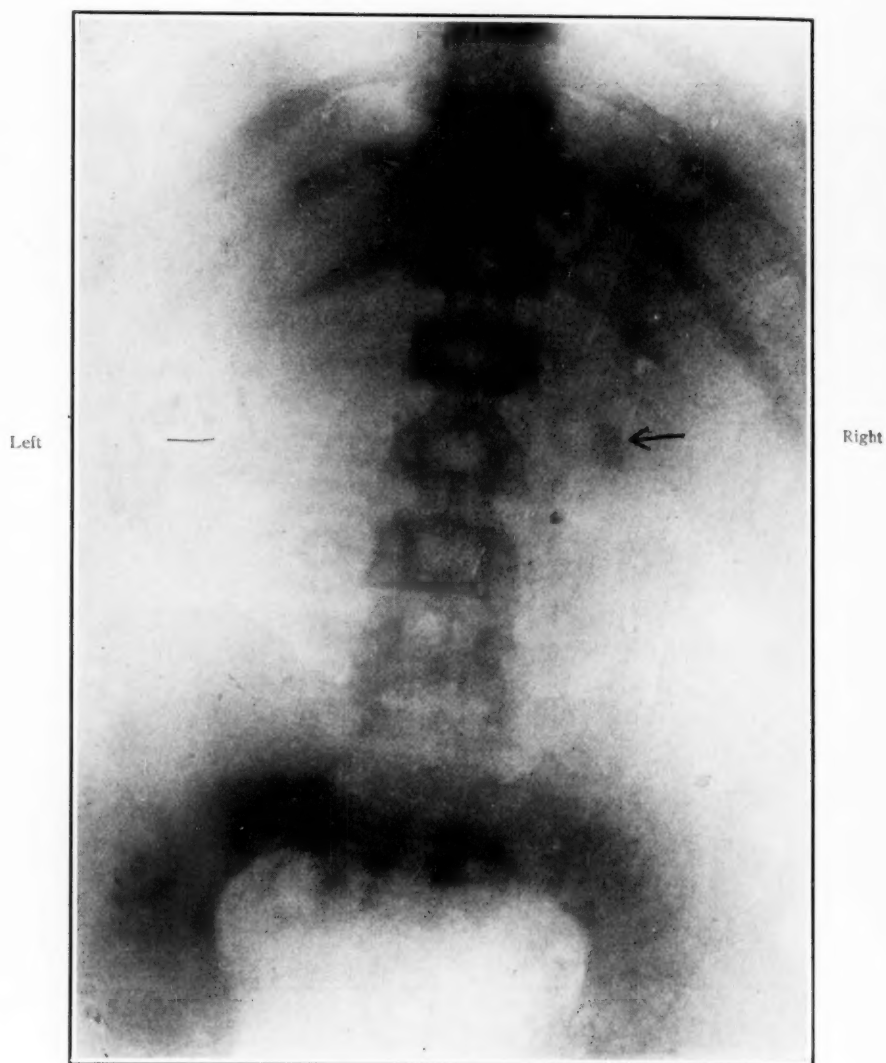
FIG. 5.—Four stones in left kidney.

Left

Right

FIG. 4.—Single small stone in right kidney.

below with a lead plate having a circular opening three inches in diameter. This lead plate or diaphragm cuts off all the rays except those that come from the centre of the tube, thereby increasing the sharpness and clearness of the image. The patient is placed upon the table with thighs flexed upon the abdomen and head elevated so as to bring the back as closely in contact with the plate as possible. Hard pillows or sand-bags may be used to support the knees and head. The sensitive plate, supported by a heavy, flat, steel plate, is placed beneath the patient. The steel plate, besides giving support, obstructs any extraneous rays that may be given off by objects beneath the patient.

If it is desired to secure a still clearer picture of any part of the field, the apparatus devised by Albers-Schönberg, as shown in Fig. 2, is employed. Rumpel and Albers-Schönberg have shown that much of the failure in kidney-stone work is due to the diffusion of the rays in passing through the tissues, and that by the use of lead diaphragms or lead cylinders the extraneous rays may be cut off and much of the diffusion and consequent loss of detail avoided. The pressure of the heavy lead cylinder serves to diminish the respiratory motion of the abdominal organs, and also to materially reduce the thickness of the patient. Albers-Schönberg [12] lays down the following as the features that should characterize a good skiagraph of the kidney region:

1. It must show the transverse processes of the vertebræ.

2. It must show the last two ribs with structure.

3. It must enable one to differentiate the border of the psoas muscle from the quadratus lumborum.

When the lead cylinder is used, it is necessary to take two or three different negatives in order to cover the field of the kidney and ureter. This disadvantage is more than compensated by the gain in clearness of detail obtained by this method, especially in cases where doubtful or small shadows have been obtained in a general view of the entire region taken by the ordinary method.

In corpulent persons the pressure of the lead cylinder apparatus gives a considerable diminution in the thickness of

tissue to be penetrated by the rays, thereby shortening the exposure and diminishing the loss of detail by diffusion.

For diagnostic purposes, the plates themselves and not prints made from them should be relied upon as being of most service, since no print preserves the detail and delicate gradations of the original negative. The negatives should be examined by placing them in a window and observing them by reflected skylight or in an apparatus illuminated by incandescent electric light reflected from white surfaces. The use of an opera-glass, as suggested by Kümmel, is often very useful in the examination of a plate, because it limits the field of vision to the size of the plate when the observer stands six to ten feet away.

The Röntgen ray skilfully and properly applied makes it possible to make both positive and negative diagnoses of renal calculi with a very low percentage of error. It also gives much valuable information as to the size, number, and location of stones when present (Figs. 3 and 4), and enables the surgeon to approach an operation for nephrolithiasis with an exactness of knowledge not possible before the introduction of the X-ray as a means of diagnosis in diseases of the kidney.

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[10] Rumpel. Die Diagnose des Nierensteins.
[11] Eppinger. Fortschritte auf dem Gebiete der Röntgenstrahlen, Band vii, Heft 1.
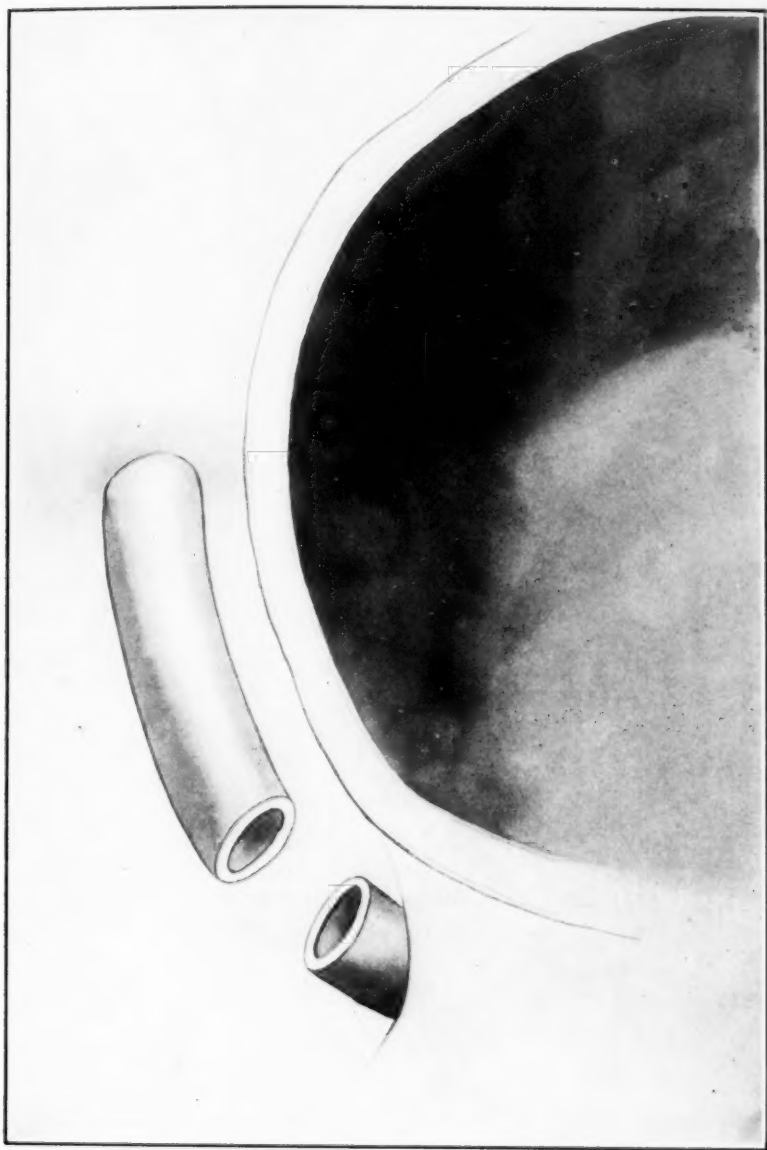[12] Albers-Schönberg. Die Röntgentechnic, p. 191.

FIG. 1.—Ureter accidentally cut in vaginal hysterectomy. The upper cut end leads from the kidney, the lower end to the bladder. Semidiagrammatic.
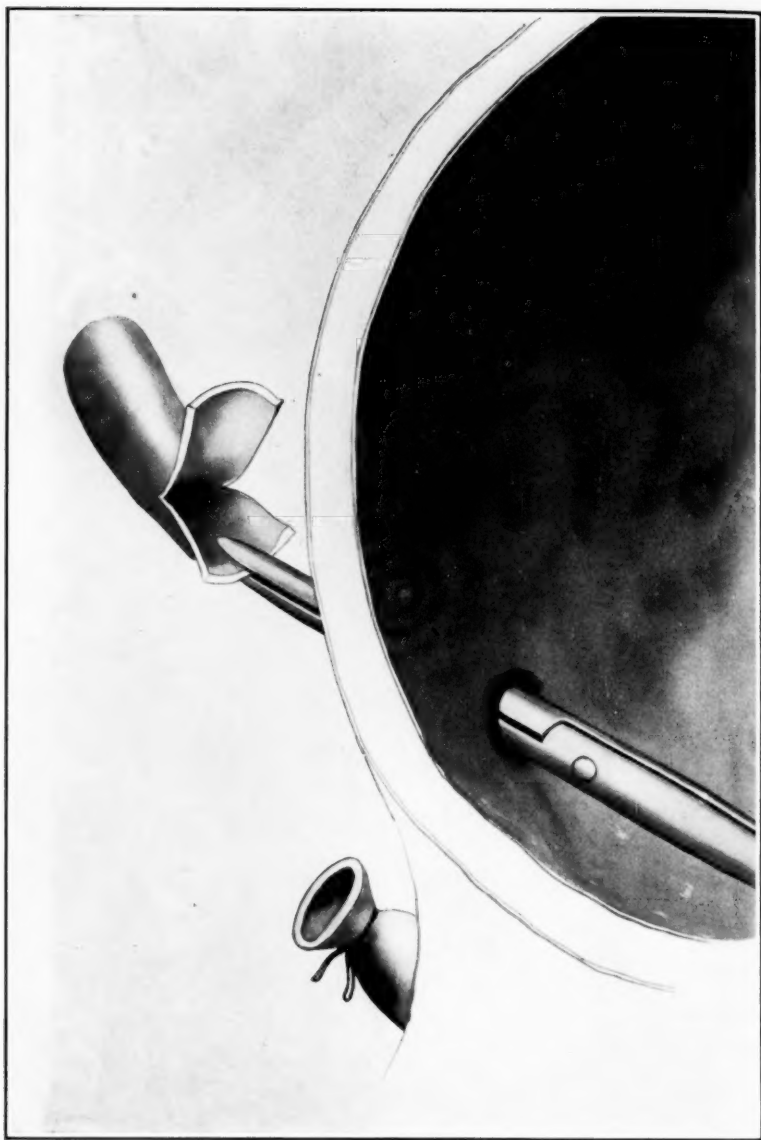
FIG. 2.—The upper cut end of the ureter split and in the grasp of a forceps which has previously made an opening from the interior to the exterior of the bladder by puncture. Semidiagrammatic.

URETEROCYSTOSTOMY FOR ACCIDENTAL WOUND OF THE URETER IN VAGINAL HYSTERECTOMY.[1]

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ON April 22, 1903, I performed vaginal hysterectomy for carcinoma of the corpus uteri upon à woman seventy years of age, a patient of Dr. Lord, of Plano, Illinois, whose pelvic organs long since had passed into extreme senile atrophy. In making the opening into the peritoneal cavity between the bladder and the uterus, the carcinomatous disease was found to have extended so far anteriorly that the bladder was opened immediately in front of the cervix uteri. An opening into the peritoneum posterior to the uterus was made without accident, the broad ligaments were then isolated and cut close to the uterus and the uterus removed. After cutting through the right broad ligament, a spurt of fluid was observed, which upon examination proved to have come from the right ureter, showing that the ureter had been divided. This accident to the ureter was consequent upon the fact that the cicatricial tissue of an old cervical laceration had caught it and drawn it into such close relation with the uterus that it came in the line of the incision (Fig. 1).

After a hasty consultation with Dr. Kolischer, who chanced to be present, it was decided, if possible, to establish a direct communication between the upper cut end of the ureter and the interior of the bladder. The usual method of performing this operation is to make an opening into the bladder, push the end of the ureter through, and fasten it there by means of sutures. Appreciating the well-known tendency of the cut end of the

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ureter to contract when introduced into the bladder in this way, and having at hand a vesicovaginal fistula which rendered the interior of the bladder quite accessible, I made use of a method which, so far as I know, had not been described. With a long slender forceps I punctured the bladder wall from within outward at the point nearest to the cut end of the ureter. Then after splitting the cut end of the ureter and denuding the bladder mucosa on either side of the punctured opening, I drew the ureter into the bladder (Figs. 2 and 3), and stitched it there by means of fine chromic catgut sutures (Fig. 4). By this means the split end of the ureter was held widely apart by means of sutures, so that it could not easily contract, and form a stricture. The tightly fitting ureter made the punctured bladder wound water-tight.

The vesicovaginal fistula was closed immediately by drawing the anterior margin of the peritoneum down to the lower margin of the vaginal wound and fastening it there with a continuous chromic catgut suture. In like manner the posterior margin of the peritoneum was brought into contact with the vaginal margin of the wound, after which the wound from the peritoneal cavity into the vagina was closed in the usual way, the stumps of the broad ligaments being drawn down into the vagina and fastened there by means of sutures, one at each end of the vaginal wound. During the two weeks following the operation, the bladder was kept empty by the continuous use of a self-retaining catheter.

Cystoscopy by Dr. Kolischer and myself some weeks later showed a perfectly patulous opening of the ureter, the divided flaps of which were firmly united to the bladder mucosa.

The special advantages of the method, as already pointed out, are twofold: 1. A water-tight wound around the ureter where it enters the bladder. 2. Security against contraction of the end of the ureter where it enters the bladder. These advantages in a similar case would lead me to repeat the operation if the bladder happened to be opened, and I would be inclined to make an artificial vesicovaginal fistula for this purpose if the bladder was not open.
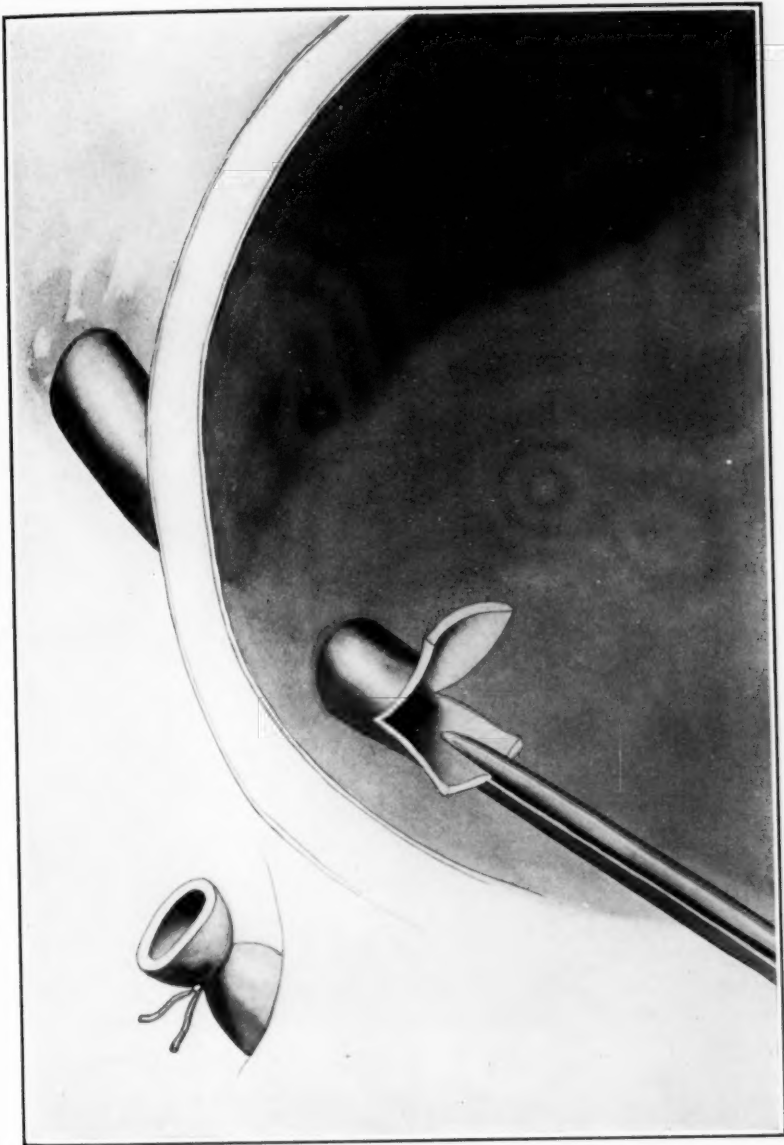
FIG. 3.—The split end of the ureter has been drawn into the bladder by means of the forceps. Semidiagrammatic.
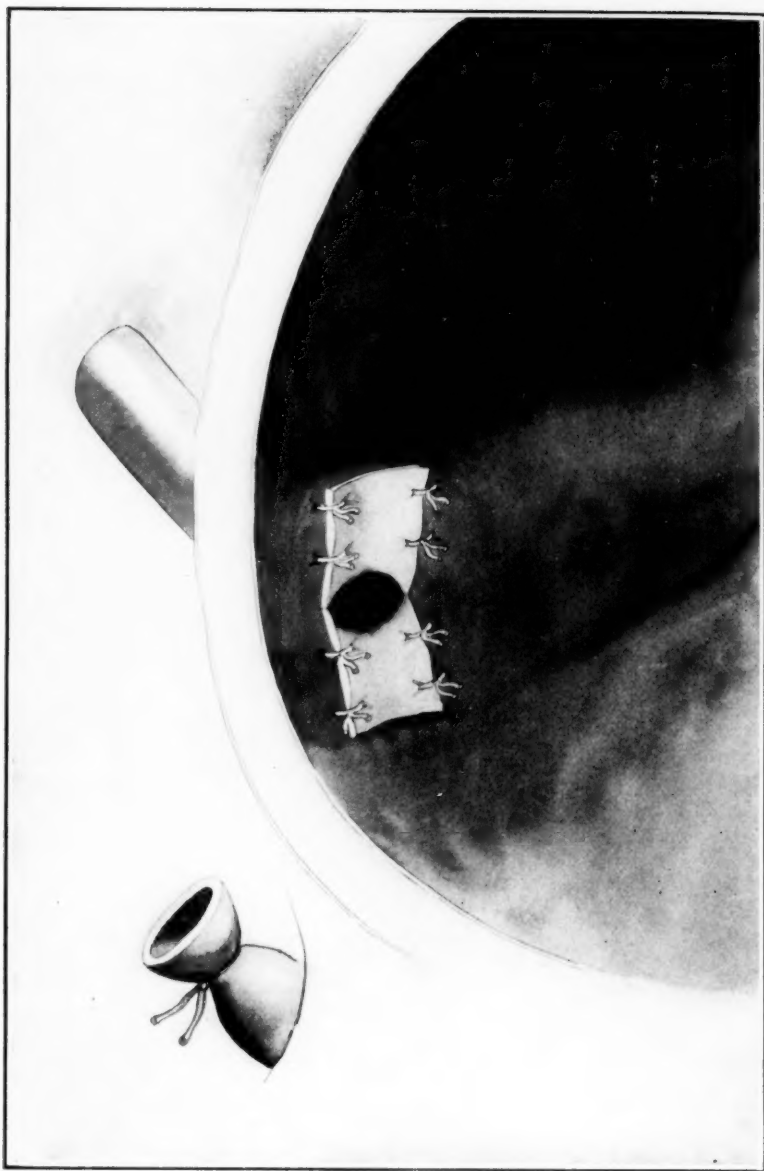
FIG. 4.—The split end of the ureter having been drawn into the bladder and the bladder mucosa having been denuded on either side of the opening, the two flaps are fastened to the scarified mucosa by means of sutures, three on each side.

INJURIES TO THE AXILLARY VESSELS OCCUR-
RING DURING OPERATIONS FOR CAR-
CINOMA OF THE BREAST.

BY RICHARD R. SMITH. M.D.,
OF GRAND RAPIDS, MICHIGAN.

RECENTLY, while operating for carcinoma of the breast, in severing the pectoralis minor and the underlying fascia from the coracoid, I accidentally drew the axillary vein into the bite of the scissors. As a result, a transverse cut, involving about a third of the vessel's circumference, was produced. A catgut ligature, completely occluding the lumen, was at once placed above and below the defect, and the operation proceeded in the usual way. An uneventful recovery followed, no circulatory disturbance of any kind being noted. The patient was seen for the last time three weeks after operation.

Upon seeking information in regard to similar injuries, I found very little that was satisfactory. The text-books mentioned the subject only in a casual way, and a review of the articles on carcinoma of the breast published during the last five years gave little bearing on it. Thinking that the collective experience of a number of operators would be of interest and of value in determining the results of such injuries. I sent a letter to a considerable number of American surgeons asking for the number of cases which they had, which vessel was injured, how the accident occurred, how it was treated, and what was the result. I received replies from seventy-one. Of these, forty-four had never injured the axillary vessels; twenty-seven reported one or more cases.

The following are abstracts of the letters received:

BECK, CARL, New York. One case in which there was an extensive glandular enlargement in the axilla, the vein being embraced by the glands. " There was some technical difficulty,

757

but the case did well." He has had to ligate the vein four or five times, never the artery.

BLOODGOOD, JOSEPH C., Baltimore. We have had 300 or more complete operations. As far as I can recollect, there has not been a single injury to the artery. On a few occasions, two or three, the vein has been torn, but in each instance immediately sutured. We have had therefore no complications whatever from injury to vessels. On four or five occasions we have deliberately excised large portions of the vein because a gland or two was adherent. There have been no complications following such a dissection. In a careful denudation of the axilla for cancer of the breast, I am inclined to think that injury of the axillary vein or artery should be a very rare accident. Adhesions to the vein and artery are present only in a slight number of cases, and even here, if the dissection is carried on slowly and carefully, a complete operation may be performed without difficulty.

BULL, WILLIAM T., New York. He has no notes of such cases, but recalls indistinctly having once cut the axillary vein nearly across in dissecting away some adherent glands. No ill results followed.

COE, HENRY C., New York. He has seen the axillary vein punctured in dissecting out the sheath in three or four cases without bad results. In one of these cases the vein was ligated, in another it was tied at the side without occluding the lumen.

DEAVER, JOHN B., Philadelphia. He has injured the axillary vein in a number of cases, and has repaired the injury by a lateral ligature. He has excised a portion of the axillary vein in bad cases. When it is difficult to practise lateral ligature or when there is some uncertainty about its retention, he puts on a forceps which does not occlude the lumen; this forceps is removed the third day. He has always had good results, both immediate and ultimate, in all his cases.

GERSTER, ARPAD G., New York. " Numerous instances." He has never injured the vein accidentally. Avoids this by a very free exposure of the field and of the large vessels above and below over the region holding close relation with the tumor. Never dissects separate adherent glands from the axillary vein, but prefers to excise the adherent portion of the vein in one piece with all fatty and glandular contents of the axilla, this being done, of course, after preliminary double ligature of the vein above and

below the parts to be excised. No ill consequences following the interruption of the venous current. A slight œdema occurred very rarely. Healing progressed normally.

HARRINGTON, FRANCIS B., Boston. Harrington has once or twice cut off one of the branches so close to the axillary vein that it has been necessary in tying to diminish the size of the lumen in the main vessel, but without actually occluding it. He has never recognized any bad results from this cause. He believes that the vein can be sutured with fine silk without producing a thrombus or interfering with the blood current.

HENROTIN, FERNAND, Chicago. Out of probably 150 cases of cancer of the breast, he has never torn the vein wide open. A few times he has injured it so that it gave rise to a good deal of hæmorrhage, but he has been able to catch the tear with a Billroth forceps and to throw a fine catgut ligature around it sufficiently secure to stop the hæmorrhage. No mention of results was given.

JEWETT, CHARLES, Brooklyn. He has never injured the axillary vessels directly. In two cases marked œdema developed several weeks after operation, and he believes that this came from obstruction to the vein caused by contraction of scar tissue. The œdema was permanent. In both these cases the patients died from metastatic growths.

McBURNEY, CHARLES, New York. One case. Case of recurrent carcinoma of the axilla. Deliberate and intentional resection of about two inches of the axillary vein. Enlongated mass of carcinomatous tissue entirely surrounding and densely adherent to the vein. Vein ligated above and below and intervening section removed. Recovery uneventful. Œdema of the arm expected, but did not occur. McBurney remarks that the arrangement of the veins is really so varied that the ligature of what appears to be a full-sized axillary may cause little or no interference with the current. Modern aseptic methods have done much to remove the danger which formerly existed when the axillary vein or artery was ligated.

MARCY, HENRY O., Boston. Two cases of suture of the axillary vein without untoward result, the circulation being unimpaired after the suturing. He uses a very fine kangaroo tendon continuous suture. A double continuous suture preferred where it can be easily applied. Suture applied in such a way as to leave

the inner surface of the vein smooth. He has also applied this method to the common iliac and twice to the femoral vein. All his injuries were accidental. In all he has had good results, the circulation being undisturbed.

MAYO, W. J. and C. H., Rochester, Minnesota. Have twice injured the axillary vein and once the subclavian. Two cases were treated by a suture of fine catgut, the wall of the vein was puckered up considerably, but no trouble followed. The third was a lateral ligature applied to cover a defect made in the main vessel by cutting off a branch close to its wall. The ligature was applied with a needle to prevent slipping. No swelling of the arm occurred in any of these cases.

MEYER, WILLY, New York. One case. A patient with far advanced axillary involvement. Resection of the vein seemed contraindicated. The long thoracic vein tore off just at its entrance to the axillary vein during the attempt to loosen the glands from the vessel. The bleeding point was grasped with mouth-toothed artery forceps. By pulling the lower wall of the vein downward and upward he succeeded in placing a lateral ligature. Patient recovered.

MONTGOMERY, E. E., Philadelphia. One case. Controlled by lateral ligature. The accident was produced by dissecting off some glands which lay directly on the surface of the vein. Patient subsequently had gangrene of the thumb on the opposite hand, from which she died.

MORRIS, ROBERT T., New York. Two cases of tear in the axillary vein,—one was small and was closed with purse-string suture; the other was nearly one-half an inch long and was closed with running catgut. Both patients made a good recovery. He states that it is a common thing to see some swelling of the arm on account of the removal of lymph vessels, and that one would have some difficulty in determining if any part of the swelling was due to the interference with venous return.

MURPHY, J. B., Chicago. Two cases. One, a tear with the finger, producing a considerable opening in the vein. This was done while endeavoring to separate a firm adhesion from the gland which was the seat of a " mixed infection." In the other case the injury was done with the scissors, he not having recognized the wall in its location, compressed between two large glands. In each of these cases he made a continuous suture with

catgut, and in each there was recovery without thrombus so far
as could be determined by the circulation of the arm.   The
largest laceration of the vein which he ever made was by putting
his entire thumb into the subclavian in removing firmly attached
tuberculous glands.   There was a gush of blood when the thumb
was removed.   It was immediately reinserted, and kept there
while he grasped the edges of the vein at one angle with forceps
and kept applying one forceps after another until he had five of
them on the rent.   When the thumb was entirely withdrawn, the
vein was closed by an over-and-over stitch with catgut, the
threads passing between each of the forceps, the thread being
pulled taut as the forceps was withdrawn.   Patient made an un-
eventful recovery.   This occurred shortly after his experimental
work with arterial suture, otherwise he believes he would have
had a serious time with his patient.

NANCREDE, CHARLES B., Ann Arbor, Michigan.   Case 1.
Recurrent axillary growth.   Injury to the axillary vein.   The
vein secured with some difficulty between two ligatures.   No harm
resulted.   Case 2.   Recurrent axillary growth.   Injury to the
axillary vein or the subscapular vein close to the main vessel;
thinks the former.   Secured by ligation after considerable bleed-
ing.

OCHSNER, A. J., Chicago.   He has many times injured the
axillary vein by cutting off one of the branches too close to the
main vessel during dissection.   The main vessel has been torn
a little in trying to catch and ligate the bleeding point.   In one
case, having torn into the axillary vein and having attempted to
place a lateral ligature, he was obliged to ligate the whole vein.
There was some œdema of the arm for one month, after which
the trouble disappeared without leaving any bad effects.

PARK, ROSWELL, Buffalo.   Two cases.   Park has twice
applied sutures of fine silk to injuries to the axillary vein, and
once has left hæmostatic forceps on either the axillary or sub-
clavian, he could not exactly tell which, but thinks the latter,
because he was working through an opening near the clavicle.
All three cases did well.   In the case in which forceps were
used, they were removed in forty-eight hours without further
hæmorrhage.

POWERS, CHARLES A., Denver.   Has been obliged to com-
pletely ligate the axillary vein three times, and in six or eight

other occasions has put on a side ligature. He has never had definite trouble follow.

RICHARDSON, MAURICE, Boston. In probably 500 dissections of the axilla he has been obliged to resect the vein two or three times. This was made necessary by the disease. When there was simply an injury to the axillary vein, he has been able to make a satisfactory suture. There were no ill consequences in any of his cases.

SENN, NICHOLAS, Chicago. Several cases in which the vein was excised. A passive œdema was the only immediate ill result.

STONE, ISAAC S., Washington, D. C. One case. One of the branches of the axillary vein torn from the main vessel. A clamp applied to the tear and a ligature carefully placed in order not to include much of the large vein and occlude its lumen. A slight swelling of the arm occurred. Patient made an excellent recovery.

VAN HOOK, WELLER, Chicago. Has several times injured the axillary vein, and has succeeded in putting on a lateral ligature except when the vein was involved in growing carcinoma, and when in consequence a portion of the vein had to be removed. He has never seen any ill results. He does not think that injuries to the walls of large veins in aseptic wounds are feared by experienced surgeons. He believes such injuries are of common occurrence, and, in the absence of suppuration, are followed by no ill consequences.

WARREN, J. C. (by Walter B. Odiorne), Boston. One case. Carcinoma of the breast with involvement of axillary and cervical glands. Both axillary and supraclavicular glands were removed. Two years later, during a secondary operation for the removal of an enlarged gland just above the clavicle, this being the first sign of recurrence, an injury occurred to the subclavian vein. The clavicle had been previously divided. The profuse hæmorrhage was controlled by tying both ends of the divided vein. Absolute rest of the arm for several weeks, during which time there was considerable swelling; but this subsided, and patient regained entire use of arm. Died one year later of " general recurrence." The presence of old scar tissue, which made the dissection very difficult, was the cause of the accident.

CUSHING, ERNEST W., Boston. One case. Was present when one of his assistants, in attempting to remove a malignant

growth from the axilla, punctured the artery.   There was a tre-
mendous gush of blood; the subclavian artery was compressed,
and he applied a clamp to the injured vessel.   The clamp was left
in place eight days.   As the injury was high up in the course of
the artery, it was deemed best not to apply ligature, but to allow
the forceps to remain, since it controlled the hæmorrhage per-
fectly.   The arm became pulseless and was somewhat swollen.   It
was kept warm artificially.   The recovery, as far as the arm was
concerned, was quite satisfactory; but the patient lived but two
months, dying of extension of the malignant disease into the
pleural cavity.

McArthur, L. L., Chicago.   Has never injured the axillary
vessels during operation for cancer of the breast, but once saw the
artery cut, together with one branch of the brachial plexus, in an
operation by his house surgeon on a child two years old.   The
operation was undertaken for tubercular glands of the axilla,
secondary to vaccination.   In this case the collateral circulation
was sufficient to maintain the circulation in the arm.   The final
outcome of the accident to the nerve is not known.

Meyer, Willy, New York.   One case.   During an operation
for recurrent, glandular, axillary carcinoma, after amputation of
the breast, the long thoracic artery was torn away from the main
vessel close to the latter's wall.   An attempt was made to suture
the vessel, but the arterial wall yielded so little that he deemed
it wiser to ligate the artery above and below the bleeding point
and divide between the ligatures.   With elevation of the arm
during after-treatment, the patient recovered without any trouble,
and could use the extremity during the remainder of her life.

Murphy, John B., Chicago.   Has never injured the axillary
artery during the operations for cancer of the breast, but had a
bullet wound of the first portion of the axillary artery just beneath
the clavicle.   Resected the artery and invaginated the proximal
into the distal end with silk sutures.   There was immediate return
of pulsation of the radial, and the patient recovered without
serious disturbance of the circulation of the arm, and has remained
well.

Richardson, Maurice, Boston.   One case.   Operation for
malignant disease.   A part of the lumen of the artery was de-
stroyed.   The hole in the vessel was closed with two or three

sutures.   No bad results followed.   There was never aneurism.
The woman died some time later with recurrence of the cancer.

It was my original intention to tabulate the cases reported,
but this was impossible, since the answers, given usually from
memory, were often incomplete; the exact number of cases
and the particular line of treatment applied to each case being
oftentimes unknown.   On reading over the replies, however,
certain facts stand out distinctly, and, as these are the im-
portant ones, a word of comment may not be out of place.

Vein.—There are sixty-three cases of injury to the vein
reported.   This is estimating the expressions " several," " a
few," " a number of" to mean three, and " many," or " in
numerous instances" to mean four,—as conservative a way of
counting as possible.   In no case did permanently bad results
follow injury to the vein,* whether the vein was *wholly* or
partially occluded with the ligature or forceps.   In some cases
an œdema of the arm is reported; this is usually of slight de-
gree and transient.   Air embolism did not occur, nor did any
septic trouble arise from the resulting thrombosis of the vein.
It must be remembered that these operations were done under
aseptic technique.   The results of vein injury were not as good
before the establishment of modern methods.

The cause of injury seems commonly to have been a more
or less extensive adherence of cancerous lymphatic glands to
the vein wall, making an injury to the vein an easy or unavoid-
able consequence.   Where such a condition was found, Gerster
states that he never dissects away such glands, but prefers to
excise the adherent portion of the vein after double ligature.
This plan was carried out by several others.   A considerable
number of cases occurred during a secondary operation, an
operation which would imply considerable malignant disease in
the axilla and usually scar tissue from the previous operation.

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* See Jewett's letter.   As complete occlusion of the vein at time of
operation is rarely followed by swelling, it would seem that this phenome-
non, which is not very uncommon, would call for further explanation.

An injury naturally would be more likely to follow.   Actual occlusion of the vein was often deliberate and made necessary by the extent of the disease.   Slight injuries occurred accidentally. Pricking of the vein wall with a needle was reported frequently; a tearing of the vein wall was common.   Tearing away one of the branches of the vein was also a common occurrence.

Treatment.—In order to prevent injury to the vein, a very free exposure is commonly advised and practised.   Great care in manipulation while removing the axillary contents, especially where glands are extensively involved and adherent, is imperative.

Where the injury was slight, an attempt was always made to apply some form of lateral ligature or forceps.   The vein was either picked up with a forceps and a lateral ligature applied on a needle or otherwise, or a running suture was made.   Marcy lays considerable stress on the use of a fine kangaroo tendon, leaving the inner surface of the vein smooth.   He has applied this method to the common iliac and twice to the femoral, and has always had good results, the circulation being undisturbed. By others both catgut and silk have been employed, apparently with the same good results.   A forceps left on for about forty-eight hours was used by Deaver, Henrotin, Stone, and Park. When actual occlusion was necessary, a ligature was simply thrown around the vein above and below and tied; the intervening portion was sometimes cut away with the diseased tissue.

Artery.—Injuries to the artery are naturally much rarer than those to the vein.   This is undoubtedly due to the less exposed position of this vessel, the strength of its walls, and its easy detection while working near it.   As with the vein, the injury may be so slight as to suggest closing the defect without occluding the lumen, or it may be such as to make closing the artery imperative.   In none of the three cases occurring during operation for cancer of the breast, nor in the two cases undertaken for other purposes, was there serious disturbance to the circulation.   Murphy's case of invagination is of interest.   A possible complication of the injury to the axillary artery would

be an accompanying injury to one of the main nerve trunks, which lie so close to the artery. This occurred in McArthur's case. Cushing describes the hæmorrhage as being most alarming, and does not wish to have the experience repeated. The material is too meagre to deduce accurate conclusions therefrom, but we may at least say that injury to the axillary artery is not necessarily serious.

Summary.—Injuries to the axillary vein occurring during operations for cancer of the breast, performed under aseptic methods, are in no way serious. A passive œdema of the arm rarely occurs, and when it does is slight and transient. Slight injuries may be repaired by a lateral ligature or a running suture. A forceps left in place forty-eight hours may be used where the application of a suture is difficult. Where injury to the vein is extensive or when the situation of diseased tissue makes it desirable, it may be boldly tied above and below and the lumen occluded without fear of bad results.

As to injuries to the artery, the material is too meagre to allow of definite conclusions. There was no permanent bad result in the five cases reported. Artificial heat during recovery of circulation seemed necessary in the cases where the artery was occluded.

ARTERIOVENOUS ANEURISMS.[1]

A CASE OF TRAUMATIC ARTERIOVENOUS ANEURISM OF THE COMMON FEMORAL
ARTERY AND VEIN—UNSUCCESSFULLY TREATED BY A NEW METHOD OF
COMPRESSION—AND FINALLY CURED BY THE PROXIMAL LIGATION OF THE
EXTERNAL ILIAC ARTERY EXTRAPERITONEALLY—WITH THE SUGGESTION OF
THE APPLICATION TO THESE ANEURISMS OF THE MATAS METHOD OF
OPERATION USED FOR ORDINARY ANEURISMS—AND THE MENTION OF SOME
OTHER RECENT METHODS OF OPERATING.

BY WARREN STONE BICKHAM, M.D.,

OF NEW YORK.

A YOUNG negro man of about twenty-three years of age,
of athletic build and otherwise healthy, was admitted to one
of the surgical wards of the Charity Hospital, New Orleans,
in 1897, presenting a small, prominent, pulsating tumor, of
somewhat oval outline, and about 5 by 6.5 centimetres (2 by
2½ inches) in measurement, situated directly over the course
of the common femoral artery and vein, furnishing a marked
vibratory thrill and a murmur, and the pulsations ceasing upon
compression of the external iliac artery without the contour
of the tumor being materially changed thereby. At a period, as
nearly as remembered by the writer, of about ten days prior to
entrance, he had been shot by a pistol, the ball entering the outer
aspect of the left thigh, on a level, approximately, with the spine
of the pubic bone, and ranging inward across the front of the
thigh. He had gone to bed for a few days, during which he had
not suffered especially, and, upon getting up, noticed the enlarge-
ment upon his thigh. At the time of his coming into the hospital
the wound of entrance had healed entirely, no wound of exit
existed; the patient walked into the ward unaided, and complained
of nothing but the presence and discomfort of his tumor. The
ball could not be located, and no complained-of symptom pointed
to its locality.

A diagnosis of traumatic arteriovenous aneurism involving
the common femoral artery and vein was made. The contour of

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the swelling suggested the varicose-aneurism type of arterio-
venous aneurism; but it is known to be quite impossible, in the
majority of cases, to discriminate between the varicose-aneurism
type and the aneurismal-varix type prior to the actual exposure
of the tumor in the field of operation. This was found to be so
in the four cases operated upon and reported by Treves. It is
right to say that there was a difference of opinion, among those
who saw the above case, as to whether the artery alone was
wounded, or the artery and vein, the majority concurring with the
writer in the latter view.

Within the following two or three days, and before any
systematic course of procedure was begun, the patient, unaided,
and in the presence of a male nurse, urinated the pistol-ball
which had inflicted the wound. The ball, as remembered, was
one of .32 caliber, and was smooth and not changed in shape
by contact with any hard object. The patient had complained
of no symptom leading one to suspect the presence of this foreign
body within the bladder, and could describe, when questioned, no
symptom immediately following the injury suggestive of pene-
tration of the bladder. He gave no evidence of bladder irritation
before or subsequent to the expulsion of the ball by the urethra.
At the time of its expulsion, he complained to the nurse of an
unnatural sensation; there was a temporary stoppage of the flow
of urine, and then the ball was forced through the urethra, drop-
ping from the end of the penis into the vessel with a noise as
though ejected with some force. It is not plain by what route the
ball entered the bladder. Considering the point of entrance and
the position, to the outer side, of the party firing the pistol, the
most direct route would have been by passing through the thy-
reoid foramen of the innominate bone; but it would be difficult
to see how that could be accomplished without greater damage
to the vessels than a tearing off of a small part of the roof, or
anterior aspect, of femoral artery and vein, which was supposed
in this case. And if the ball ranged upward, over the superior
border of the pubic bone, by way of the prevesical space, it must
have met a very much distended bladder. There was no evidence
that a fracture of the innominate bone had been sustained.

The patient was now put to bed, the bowels thoroughly
moved, and a low diet instituted. Though realizing the usual
inefficacy of methods of pressure, these were, nevertheless, tried.

Digital compression of the external iliac was first used, and, later, compression with a broad rubber bandage, applied from toes to hip-joint. Then a special form of compression, which suggested itself to the writer, was tried experimentally. The tumor and adjacent regions of thigh and groin were shaved; these parts were then lubricated with vaseline; upon this smooth lubricated surface, extending downward from Poupart's ligament for about fifteen centimetres (six inches) below, and around the anterior half-circumference of the thigh, wet plaster-of-Paris was put, being especially built up about the tumor, and when this had hardened and come away, a reverse cast of the part was obtained. Into that special part of the concavity of this hollow which represented, and was made by, the convex tumor, cotton was closely packed, until very nearly but not quite all of the cavity moulded upon the aneurism had been built up and obliterated. The whole cast was then replaced, so that it fitted very exactly the parts from which it was taken, except that the aneurism did not fully fill its former cupped-out cavity in the cast, but only occupied that concavity to a very small extent. This cast was then pressed well into position, and held firmly in place by a spica bandage, the entire limb being supported by ordinary bandage from the toes, the idea being to bring to bear a considerable degree of firm pressure and compression upon the aneurism by the forcing of it into a smaller, and especially shallower, cup than it had made in the original cast, aided by the purchase, so to speak, which the rest of the clinging cast secured by fitting so accurately the parts upon which it had been moulded. This apparatus was applied upon two occasions and kept on a number of hours, and, while it caused no marked discomfort, no result was accomplished by its use. The writer has not used this method of pressure and compression in any case of simple arterial aneurism, but believes that it might find some field of application in certain cases, provided any method of pressure were to be used at all.

It was now decided to first ligate the external iliac artery proximally, in hope that ligature of the artery above would suffice, and, should this fail, to subsequently ligate the femoral vein below the sac, or upon both sides, as indicated at the time of the second operation, thus giving the patient every chance to maintain his venous circulation intact if the arterial had to be so largely sacrificed as necessitated by ligature of the external iliac. After,

25

therefore, giving the patient an opportunity to recover from the attempts just described, he was anæsthetized and the external iliac artery tied extraperitoneally, by an incision parallel with and 1.3 centimetres (one-half inch) above the outer two-thirds of Poupart's ligament, followed by a pushing upward of the intact peritoneum, the artery being readily exposed and ligated with silk. An exceptionally large, flat, lymphatic gland, completely saddling the artery and lying directly over the site of ligation, and rather closely adherent to the sheath of the vessel, was the only complicating feature encountered. The patient was put to bed with the entire limb surrounded with a cotton and gauze dressing from toes to hip, and additional warmth temporarily supplied by hot-water cans. The ensheathing of the limb was retained for about ten days, with occasional examination of the circulation of the toes, at the end of which time the wound-dressing and the ensheathing were removed. Union had been primary. The tumor had disappeared. At about the end of another week the patient left his bed, and during the following days, while he was under observation and walking about, no return of the circulation in the aneurism occurred.

An interesting question, and probably the most interesting one in connection with the case, comes up as to whether, in the present light, this would have been the best course of procedure; although, in this particular instance, all ended well. It is known that with the more general use of weapons of small caliber, arteriovenous aneurisms are of more frequent occurrence than formerly. And the risks of gangrene, and even death, following the ligation of the larger arteries and veins are well known. The statistics of both pre-antiseptic and antiseptic days show this. In Van Buren's report of seven cases of ligation of the external iliac or common femoral artery for arteriovenous aneurisms, gangrene followed in all. Curtis collected fifty-one cases of arteriovenous aneurism in general, treated by ligation, of which twenty-three died, eight were cured, two improved, eighteen unimproved, and gangrene occurred in eleven cases. Billroth found he had secondary hæmorrhage in 50 per cent. of all large vessels ligated in continuity. Murphy reports twenty-

two ligations of the femoral artery and vein, with gangrene in twelve. He has collected 178 cases of ligation of the femoral artery alone, with gangrene in twenty-five. He also reports thirty-one ligations of the femoral artery for aneurism, with hæmorrhage in 60 per cent. and death in 40 per cent. From these figures, though very imperfectly covering the field, it is clear how many lives are lost through the cutting off by ligature of the main blood supply of the parts. Recognizing, therefore, the present greater frequency of arteriovenous aneurisms, and the large proportion of disastrous results following ligation of the larger vessels, it would seem wise to devise some more satisfactory method of treating this form of aneurism. The most usual and the most successful form of operative treatment of these cases resorted to until comparatively recently has been some form of ligation, either of the artery above the sac, or above and below, with or without ligation of the vein below the sac, or below and above; the best procedure generally being considered to be the ligation of the artery and vein above and below the aneurismal sac, followed, in cases of the varicose-aneurism type of arteriovenous aneurisms, by excision of the sac, or as much of it as possible.

The operation performed by the writer in the above case was done before the introduction of the Matas' epoch-making method of operating for aneurism, and the writer is not aware that the Matas method has ever been used, or suggested, in the case of arteriovenous aneurisms. If not, he would suggest the application of this more modern method of operating to this special class of aneurisms, provided the conditions present offered an opportunity to apply the principles of that operation, and thus endeavor to not only preserve the integrity of the artery and vein, but also, in consequence, to spare the patient the great risk attendant upon the loss of circulation through one or both of these vessels. It is a known fact, as mentioned above, that the nature of arteriovenous aneurism cannot always be determined clinically, and, in some cases, is only discovered when the site has been exposed by operation. But it would seem warrantable to expose the aneurism in every appropriate

case; and if the Matas operation be then found inapplicable, one of the more usual methods just mentioned could be adopted, or the original wound could be closed, and the artery ligated proximally, at some distance above, or one of the methods, other than the Matas method, to be mentioned below, might be used.

If the arteriovenous aneurism were of the varicose-aneurism type (that is, with an aneurismal sac intervening between artery and vein and communicating with both vessels by separate mouths), the writer would be inclined, where circumstances were favorable, to apply the Matas method, namely, after temporarily controlling the circulation through the involved vessels, lay open the intervening aneurismal sac, locate both the arterial and venous openings into it, and close them off by fine chromic gut Lembert sutures applied interruptedly, followed by obliteration of the sac in his characteristic manner of suturing its roof, including the overlying parts, to its floor. It is to be remembered that an endothelial layer usually lines the cavity of an arteriovenous aneurism, and is especially apt to be present near the openings into the sac; although the absence of an endothelial lining would not seem to be a contraindication to the application of this method, as the surfaces of even a pure connective-tissue sac could be roughened by curettement to promote adhesions of its walls. This technic is shown in Fig. 1.

If the arteriovenous aneurism were of the aneurismal-varix type (that is, a varicosed dilatation of a vein caused by the force of the arterial circulation poured into it through a direct communication from an artery, without an intervening aneurismal sac), and the conditions were favorable for this form of operation, while the typical Matas method, owing to the absence of a sac, might not be so applicable, yet a modification of that method would seem feasible. And here the writer would suggest the following modification of the Matas technic, namely, make a longitudinal incision through the enlarged and varicosed vein for as limited an extent as would seem to afford approach to the opening into the vein, and so placed as to lie directly opposite this communicating opening from the artery, retract the lips of this wound in the vein, thus

FIG. 1.—Varicose-aneurism type of arteriovenous aneurism of left common femoral artery and vein—showing the application to this class of aneurisms of the Matas method of operating upon ordinary aneurisms. The opening of the femoral artery into the common aneurismal sac is shown on the right, with interrupted Lembert gut sutures in position, ready to be tied. The opening of the femoral vein is seen on the left, with similar Lembert sutures in position. On the left of the sac two gut sutures are in the act of being placed, which, when tied, will approximate the roof of the sac (including skin and intervening tissues, which are not here shown) to the floor of the sac. Similar sutures will approximate the roof and floor of the sac upon the right.
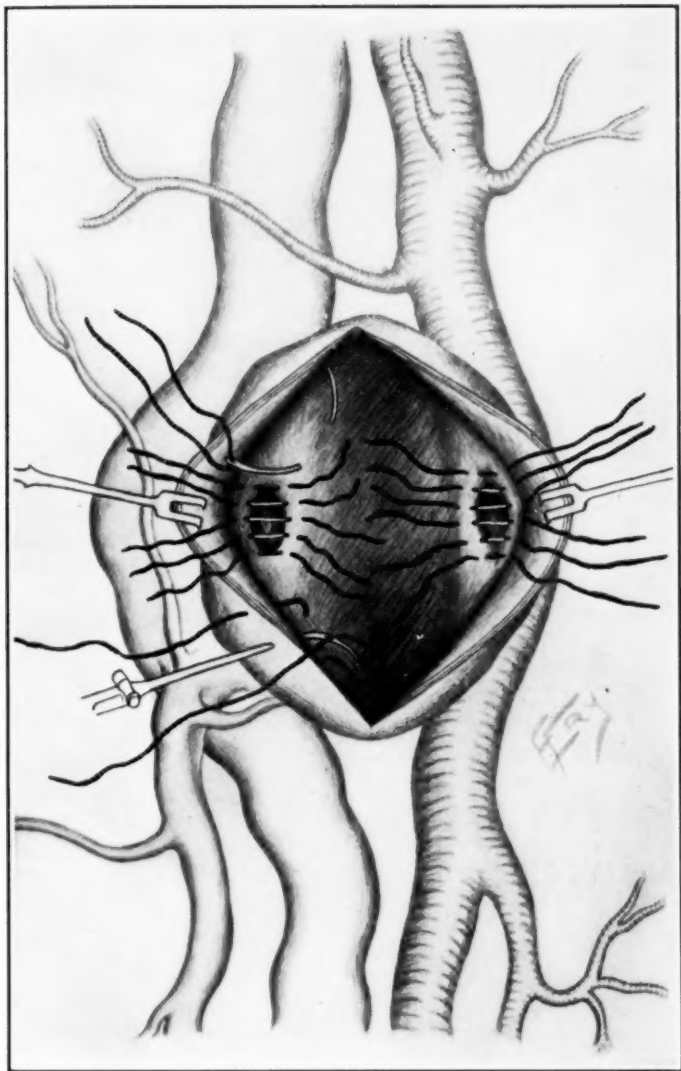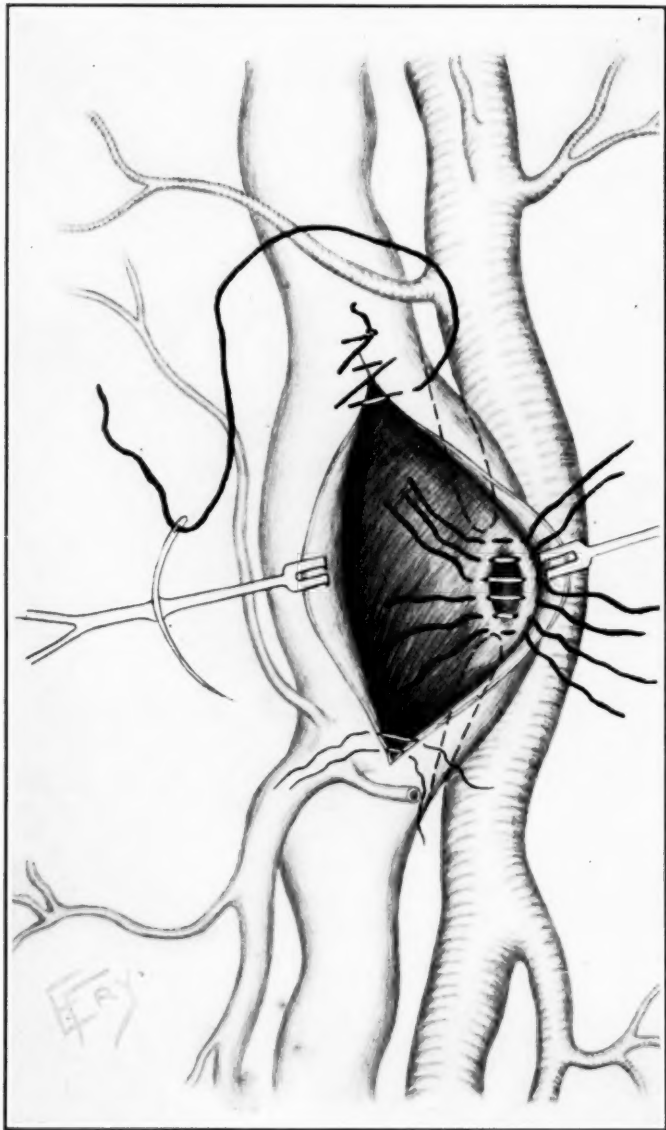
FIG. 2.—Aneurismal-varix type of arteriovenous aneurism of left common femoral artery and vein—showing the application to this class of aneurisms of the Matas method of operating upon ordinary aneurisms. The opening of the femoral artery into the varicosed vein is shown, with interrupted Lembert gut sutures in position, ready to be tied. The longitudinal incision in the vein, for approaching the arteriovenous opening (and which is here made somewhat unnecessarily long) is shown in the act of being closed by two methods of suturing—above, by the continuous Lembert of the outer coats—below, by interrupted ordinary sutures of the outer coats.
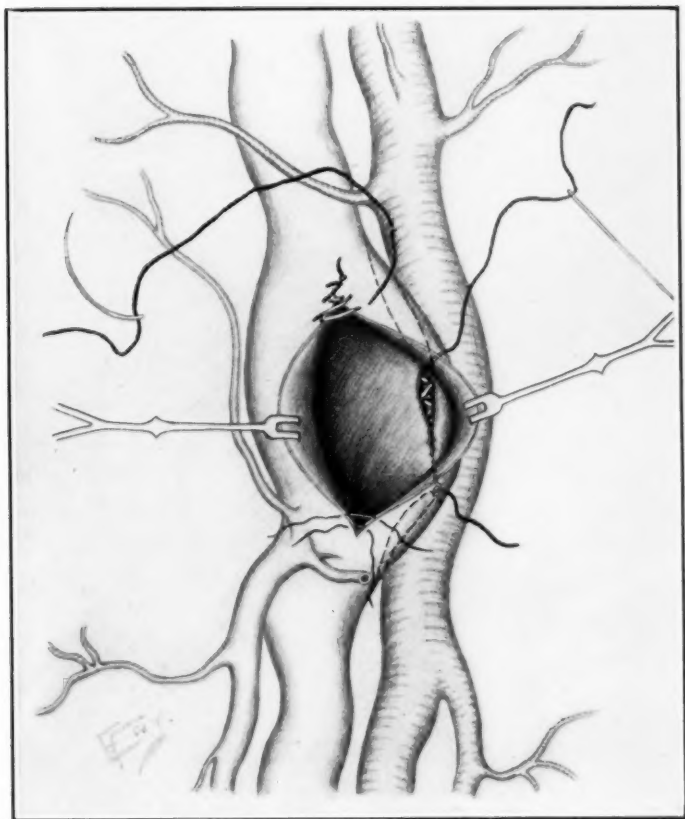
FIG. 3.—Same as Fig. 2, showing a continuous Lembert gut suture, which, having been passed through the outer coats of the thickened vein at the angle of junction of vein and artery, and knotted, is passed on between the coats of the vein until its varicosed cavity is entered very near one end of, and immediately above, the first tier of interrupted sutures—and is then made to bury-in this first tier and itself in continuous Lembert fashion—and, emerging at the opposite angle of junction of vein and artery, is tied in the same manner as at its entrance. (This suture is not yet tightened throughout.)
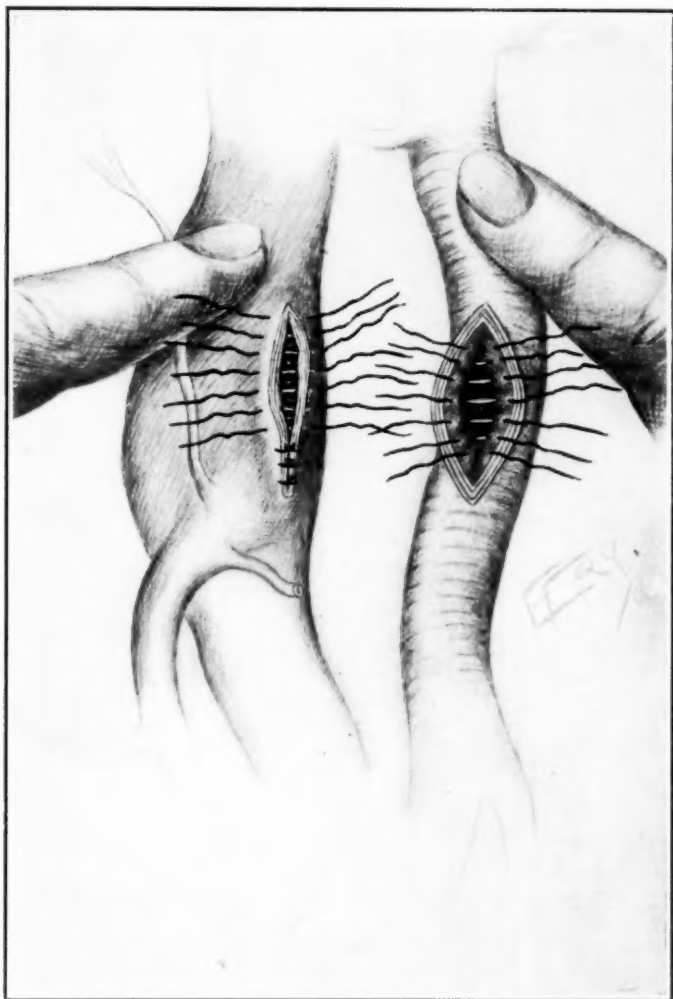
FIG. 4.—Varicose-aneurism of left common femoral artery and vein, treated by excision of the sac, followed by suturing of the openings in the vessels. Upon the right, a small elliptical piece of the sac is shown connected with the arterial opening, with the first tier of interrupted Lembert gut sutures in position, ready to be tied. Upon the left, a similar elliptical piece of sac has been left connected with the venous opening. The first row of Lembert sutures has been tied, and a second tier of ordinary sutures through all the coats is being applied, burying-in the first tier. Fig. 4 is the same as Fig. 1, with the sac excised.

exposing the interior of the vein and the arterial communication, suture up the opening of the artery into the vein in the usual Matas manner, and then close the incised vein by a continuous lateral suture of, approximately, the Lembert type. Fig. 2 illustrates this technic. Owing to the fact, in aneurismal-varix cases, that foreign material will be left in contact with the venous current by this manner of suturing (which does not apply in the varicose-aneurism cases), with the consequent theoretical possibility of pieces of the suture forming emboli, it would be well to use very fine gut for this suture, and to tie very small, closely-cut knots. Or it would be better still to bury-in the row of interrupted Lembert sutures closing off the arterial opening, by means of a continuous buried suture introduced from without entirely through the vein, at one of the angles of junction of artery and vein, passing in continuous Lembert fashion above the interrupted sutures, through part of the thickness of the wall of the vein, and out through the entire thickness of the vein at the opposite angle of junction of artery and vein, in very much the same manner as a subcuticular suture is passed, and so placed that the suture throughout its entire length and its points of entrance and exit, to and from the vein, are also buried, which, in the case of a thickened, varicosed vein would be easier of accomplishment than in a normal vein. This second tier of suturing is shown in Fig. 3.

More recently, successful artery suturing and vein suturing have been demonstrated, and these principles have been applied to arteriovenous aneurisms. In those cases of the varicose-aneurism type where both arterial and venous circulation can be controlled proximally to the sac, and the sac exposed by dissection, the aneurismal sac may, in appropriate cases, be excised up to very near the arterial and venous openings into it, and these openings then closed by a row of interrupted Lembert gut sutures, followed by a second burying-in row through the free margins of the small portion of the sac left around the jug-like opening into the artery and vein, as shown in Fig. 4. In those cases of the aneurismal-varix type, where, similarly, both the arterial and venous circulation may be arrested proximally to

the arteriovenous communication, and this site of communication be exposed by dissection, the artery and enlarged vein may, in appropriate cases, be severed from each other by an incision through the connecting opening, made parallel with artery and vein, and these openings closed by lateral ligation with fine gut or silk, the openings left by the incision of the connection between artery and vein being, in the aneurismal-varix, less jug-like and with less free margin than in the varicose aneurism. This technic is shown in Fig. 5. If necessary, these openings left by the liberating incision could be trimmed into elliptical shapes.

It is also to be remembered that portions of arteries have been excised and the integrity of the vessel established by circular arteriorrhaphy. And Dörfler has demonstrated that suture material may be safely carried through all coats of arteries and veins without producing thrombosis. So that the range of dealing with vessels by methods of suturing has been very much increased in recent years.

Matas [1] himself states that he did not contemplate the application of the method which he devised for ordinary arterial aneurisms to arteriovenous aneurisms, and to circumscribed or diffuse pulsating hæmatomas of recent origin, resulting from arterial and venous wounds, leaving these types of aneurism for the methods of arteriorrhaphy and venorrhaphy. While recognizing that it is ideal to excise the aneurismal sac of a varicose aneurism and suture up the openings in the artery and vein, and to cut apart artery and vein in an aneurismal varix and somewhat similarly suture up the openings in the vessels which the severing of the common connection between them has left, leaving the circulation intact in both class of cases; yet there must occur cases in which there is difficulty of satisfactorily exposing the parts, or where there is difficulty in, and contraindication to, the removal of the sac of a varicose aneurism, or the

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[1] See "An Operation for the Radical Cure of Aneurism based upon Arteriorrhaphy," by Rudolph Matas, ANNALS OF SURGERY, Vol. xxxvii, No. 2, page 161.
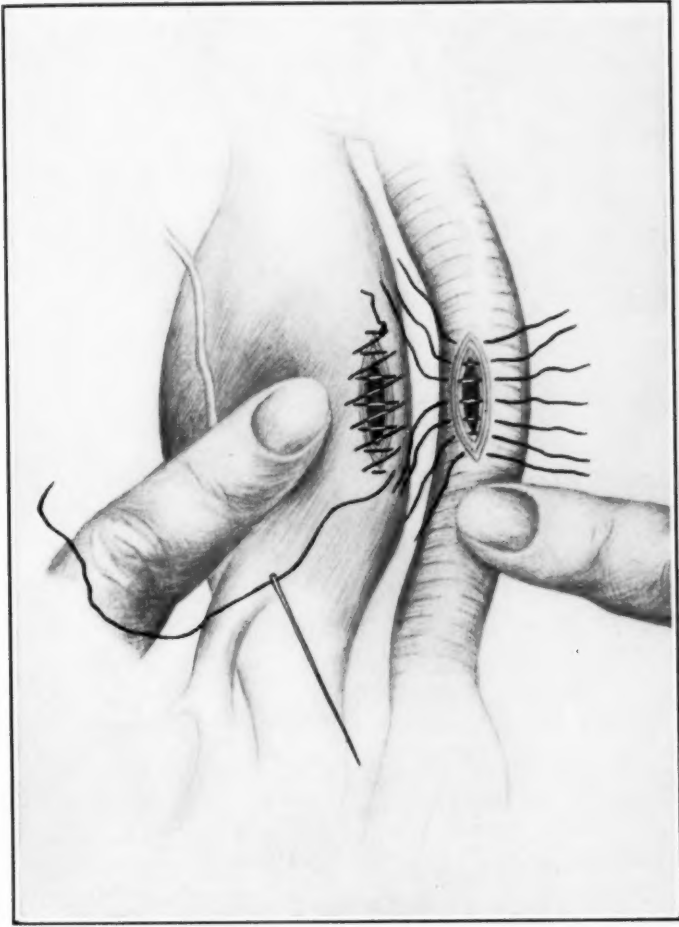
FIG. 5.—Aneurismal-varix of left common femoral artery and vein, treated by severance of vessels from each other, followed by suturing of their openings. On the right, interrupted gut sutures are shown passing through the outer coats of the artery, ready to be tied. On the left, a continuous Lembert gut suture through the outer coats is shown closing the venous opening. Fig. 5 is the same as Fig. 2, with the vessels cut apart.
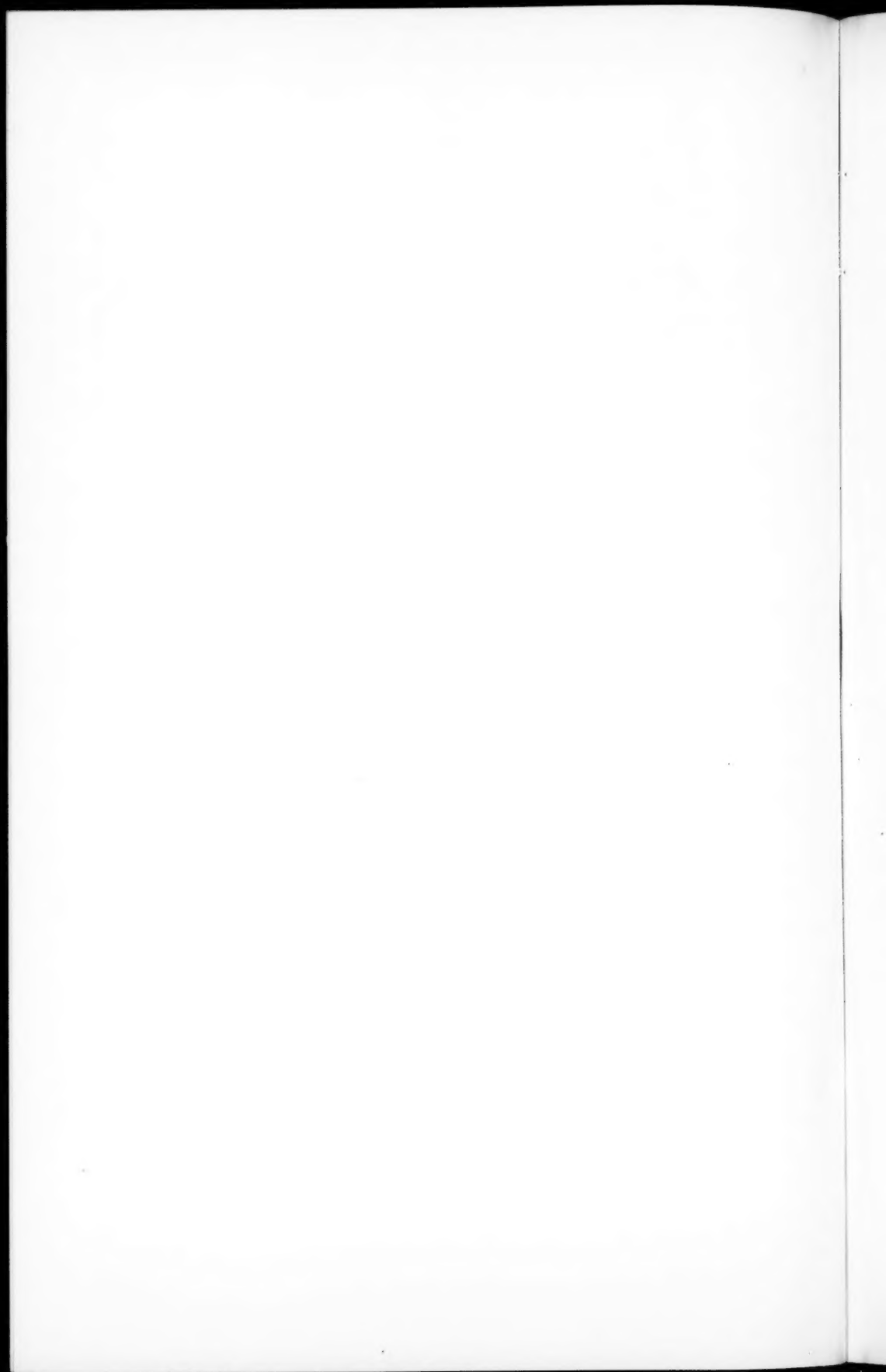
cutting apart of artery and vein in an aneurismal varix, and in such cases the Matas method would seem to be a desirable technic. And while one feature is common to all of these more modern methods, and that is, the retention of the circulation through artery and vein, yet it may be questioned where, from the circumstances of the case, it is optional, whether the Matas method would not really be preferable in dealing with the varicose aneurism type of cases; for it would seem the suturing together of the roof and floor of the sac would strengthen the suturing of the arterial and venous openings into the sac and make secondary hæmorrhage less likely, and also accomplish the end with less traumatism.

SKIN-GRAFTING INFECTED AREAS.

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By " infected areas" I mean raw surfaces which may or may not have been originally aseptic, but which have become infected, and from which pus exudes. Such surfaces are often the result of burns, extensive operations, contused wounds, or conditions of imperfect local nutrition as in varicose ulcers.

Any of these raw surfaces, when they have become infected, may take on the form of indolent ulcers, and, in spite of every method of stimulation, the cicatricial process stops, and the ulcer may increase in size. This is especially true of varicose ulcers.

The following method of preparation of the ulcer I have found to make practicable the immediate application of Thiersch's grafts, and thereby greatly lessening the time required for effecting a cure.

The whole secret of success lies in the method of rendering the septic area *aseptic*. It is a simple one, and may be described briefly as follows:

The night before the operation, the ulcerating and surrounding area should be cleansed as thoroughly as possible with green soap and hydrogen peroxide to remove the dried crusts and débris from the granulations. In case of very foul varicose ulcers, more time may be taken, and a compress wet with 50 per cent. solution of peroxide may be applied for a few days until the exudate is removed.

After cleansing, the raw surface is covered with a compress saturated with a 1 per cent. solution of formaldehyde (the ordinary 40 per cent. pharmaceutical preparation being the unit), and this compress is allowed to remain in place until the patient is on the operating table. When the com-

776

press is removed, it will be found that the granulation layer is dry and dark red in color, having an appearance much like smoked beef. This layer is about a quarter of an inch in depth; it is friable, and can easily be scraped off with a sharp spoon from the underlying tissue, which is whitish and bleeds very little. The removal of the granulation layer should be thorough, and what little oozing there is can easily be stopped by the application of the Esmarch solid rubber band for a few minutes. The use of the rubber is a valuable step in the operation, as the smooth rubber makes equable compression and does not stick to the tissues when removed, but leaves an ideal surface for skin-grafting.

The remainder of the operation is the ordinary one for the application of Thiersch's grafts, The after-treatment is the same. As a rule, at the first dressing, three or four days after the operation, the grafts are found adherent and in good order. The dressings should be done every two or three days until the healing process is complete.

I have been surprised and delighted with the success of this method in the few cases where I have tried it. Large granulating surfaces resulting from burns by molten metal, operations for the removal of the breast, and in the last case, one of a varicose ulcer the size of an adult hand, have been completely healed in a little over two weeks.

TREATMENT OF FRACTURES.[1]

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SURGERY of recent years has advanced in almost all lines, but perhaps most markedly in the direction of the various internal organs. At present, surgical literature is almost monopolized by articles on operations affecting the liver, kidneys, stomach, intestines, and the abdominal viscera generally.

Operative surgery is *the* surgery of the day, and non-operative work has become somewhat ignored. Many of us will recall the days when the subjects of fractures, dislocations, etc., formed a far more important part of one's stock of surgical knowledge than they appear to do to-day. To those of us, however, who have large surgical wards under our care, the importance of fractures should especially appeal. They are as frequent now as they were formerly, and demand the same careful skill and attention if good results are to be achieved. Let us guard against the temptation to devote our attention to the operative cases and leave the fractures too much to the care of our assistants.

The extremely rapid progress of modern surgery has been largely due to our ability to maintain wounds aseptic since the introduction of Lister's method. The treatment of fractures has been influenced by this method as well as other departments of surgery; hence we find operative measures resorted to more frequently than was previously the case. The other discovery which has been of great importance in fractures is that of the Röntgen or X-rays. It has perhaps hardly met the sanguine expectations first raised, but it has proved of very decided utility.

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[1] The Annual Address delivered before the Philadelphia Academy of Surgery, January 4, 1904.

778

In addition to the introduction of the antiseptic system and the X-rays, I find but comparatively few advances, and those mainly in the treatment of the individual fractures. Hamilton and Stimson, our old standard treatises, have not been surpassed nor displaced by any more recent publications.

The old battle between the use of plaster-of-Paris and splints is still being waged as industriously as ever. Perhaps a fair comment of present methods would be to say that the profession is hardly as conversant with the dressings at its disposal as it should be.

Bandaging used to be a fine art, but since the introduction of the gauze bandage it seems to have degenerated, and is but little studied. The gauze bandage so readily adapts itself to a part as to conduce to slovenliness in its application. Nevertheless, there is a right way and a wrong way of bandaging, and the right way is still the best.

As regards the use of immovable dressings, such as plaster-of-Paris, I have never been able to content myself to place recent fractures up in plaster and allow them to remain until union is firm. I desire to assure myself by direct inspection, once or twice a week, that the fragments are in proper apposition, and any dressing not allowing this is deemed unsuitable. For this reason, for the first ten days some form of splints is always used. In some cases the tendency to deformity is lacking, and in such fixed dressings can be used as soon as the acute symptoms have subsided. If there is any tendency to deformity, the case is treated with splints until the deformity is overcome, and then the limb can be put in plaster.

It is the custom of some surgeons to correct the deformity and then immediately apply plaster, with the idea that the plaster will hold the limb in its corrected position. This is not my practice.

Should the displacement show a tendency to recur, the plaster dressing is often insufficient to overcome it. The swelling subsides and the limb shrinks, and the plaster is no longer closely applied to it. If a plaster dressing is used, it should be in conjunction with examinations by the X-rays. By them one

is able to see the relative position of the fractured bones and be assured that they are properly placed.

The use of silicate of soda or soluble glass is hardly as common as it deserves to be. It makes a light, firm bandage, and is cleaner and more available than plaster. A physician in private practice can keep a pint bottle of it on hand, which is always ready for use; it does not deteriorate. In using it, it is only necessary to see that it really impregnates the bandage and is not simply smeared on its surface. In preparing a bandage for application, a quantity of the silicate may be placed in a basin and a gauze bandage passed through it and rolled with the hands; the surplus silicate is squeezed out and the bandage is ready for use.

Three or four bandages so prepared suffice for a broken leg. After its application, the hand is dipped in warm water, the bandage smoothed down, and the patient kept abed twenty-four hours, by which time the silicate will be quite hard. It can later be cut open with a stout knife and laced. If it is desired to lace it, it is my custom to have large hooks sewn to two strips of bandage. These are wet with the silicate and placed on each side of the cut. They are retained by a few turns of an ordinary bandage and will be hardened in place by the following day. These bandages can be prepared and kept ready for use covered with silicate in a wide-mouthed jar.

A strip of tin should be laid on each side of the leg and included in the bandage, and tends to prevent it wrinkling while being applied and drying. It is better to smooth the outside of the dressing with water rather than silicate, as the bandage dries quicker and harder. The use of starch is also worth remembering. Bandages are liable to slip, and starch adds to their security. Gauze bandages are preferable. On the completion of the bandage, cooked starch, such as is used in starching clothes, is rubbed into its meshes until a smooth, even surface is obtained. This dries in a few hours and holds the turns together, adds greatly to the appearance of the bandage, and increases its stiffness and security. It may often substitute the inconvenient and messy plaster-of-Paris bandage, and obviates

the necessity of using adhesive plaster, pins, etc., to prevent the turns from slipping.

Let me urge a trial of this starch bandage; it will be a revelation to those unaccustomed to its use. A neatly applied fracture dressing composed of bleached gauze bandages, into the meshes of which, when the bandage is completed, starch has been rubbed, is a work of art and a thing of beauty. A word on the question of bandages may not be out of place. The old bandage of unbleached muslin has been displaced in favor of the bleached gauze bandage. To neatly and correctly apply a muslin bandage requires both knowledge and skill. I almost regret to say that a minimum quantity of both often contents the surgeon in applying the gauze bandage. The rules of procedure are hardly the same in the two instances. Reverses are not so necessary in the gauze as in the muslin bandage, but it fails to give the firm support of the muslin one. With the muslin bandage, the spiral reverse was the typical form; with the gauze, the figure 8 is the standard. This is made by using figure 8 turns, one partly overlapping the other until the part is covered. Some surgeons use very narrow gauze bandages even for large parts, as the legs; this practice I hardly think is necessary. A two-and-a-half-inch gauze bandage can be used for both extremities, which can be neatly and satisfactorily covered without using a single reverse.

The question of operation in cases of fractures is a debatable one. Now that it is possible to operate almost always without wound infection, operations are justifiable when previously they were not to be thought of. The question of personal equation in the surgeon here becomes prominent. For an operation to be successful, the problems presented by the individual case must not only be skilfully handled, but the procedures must be carried out in such a manner as to insure prompt healing without suppuration.

This means that the technique employed by the surgeon must be efficient. To develop such a technique as will stand the test of the widely differing individual cases without failure necessitates both labor and experience on the part of the sur-

geon. Practice makes perfect. It is undoubtedly easier to carry out a rigid asepticism in a hospital operating room than it is in the home of the patient, where proper facilities are frequently lacking. For these reasons operations may be performed advisably by the experienced surgeon operating in a hospital that would be inadvisable in a private house by one who operates only occasionally.

The recommending of an operation entails certain definite responsibilities, and we should be prepared to meet them.

Before leaving the question of operation, I might state my belief that we do not operate on simple fractures with unbroken skin with sufficient frequency. Among such are fractures of the neck of the femur in people under fifty-five years; fractures of the upper third of the femur and some of other portions; fractures of the patella and olecranon with wide separation. In some fractures of the leg division of the tendo-Achillis is very useful. In bad fractures of the clavicle wiring is not a dangerous procedure. In elbow fractures, in which ankylosis is unavoidable, a resection will give a movable joint and much better result.

The question of operating is linked with that of failure of proper union. This is due in the larger number of cases to wide displacement of the fragments with the interposition of muscular or fibrous tissues. Hence an inability to sufficiently reduce the fragments is an indication to operate. It is not an uncommon fault for fractures to be treated conservatively which should have been operated on primarily. Many of the deformities seen to follow fractures are not only unsightly, but often seriously impair or even destroy the usefulness of the member and predispose it, as I have seen in several cases, to refracture. Modern surgery demands better results than were satisfactory in the past. It used to be the custom to practically treat all fractures conservatively and accept the results with proper resignation. This is no longer permissible. If we cannot place the fragments in such a position as to insure a satisfactory result, it is our duty, if the circumstances permit, to do so by operative means. Not only does non-union result from mis-

placed fragments, but likewise excessive callus. The paralyses and interference with the function of nerves, which not infrequently follow fractures, are often attributed to the nerve being included in and being compressed by the callus. While not prepared to deny that this may sometimes be the case, it is my belief that these nerve lesions are almost always due either to a direct injury of the nerve, usually by the fragments, at the time of fracture, or else to consecutive changes induced in the nerve by its being stretched over the sharp edge of a displaced fragment. This I have verified on several occasions. It is evident that if a nerve is stretched over the sharp edge of a fractured surface, when the callus forms it will of necessity include the nerve. For this reason it by no means follows that, because a nerve is found enclosed in callus, the callus is the cause of the symptoms rather than the injury sustained by being stretched over the sharp edge of bone. These nerve injuries are sometimes attributed to callus because their presence is so often only discovered after the removal of all apparatus and the use of the limb is attempted. It is extremely disconcerting to find, at what one has expected to be the conclusion of treatment, the unexpected appearance of this complication. It is most liable to escape recognition if fixed dressings have been employed early in the treatment of the case. This is one of the reasons that disinclines me to use plaster-of-Paris early in fractures.

In some fractures the immediate results are so disturbing as to prevent one for some days, and even longer, from ascertaining the full extent of the injuries. It is in these cases that it is particularly desirable to so dress our cases as to enable them to be examined at sufficiently frequent intervals. In some cases even a daily inspection for the first week and twice a week thereafter is not too frequent. Too often the pains of a neuritis are attributed to the broken bones and torn muscles and ligaments, and paralyses are allowed to exist unrecognized until firm union has occurred and use of the member is attempted. The formation of callus presents some interesting features. It is, I believe, due almost solely to the displacement of bone. In other words, the formation of callus is evidence that accurate approximation

has not been achieved. I had a case a few years ago which demonstrated this quite clearly.

A man had sustained a fracture of the upper third of the thigh with the customary anterior and outward displacement of the upper fragment to an unusual degree. Operation revealed a spiral fracture about two and a half inches long running upward, backward, and inward.

Traction being made by an assistant, the two fragments were fitted accurately one to the other and fixed firmly in place by two thick silver wires encircling the bone an inch and a half apart.

At the end of the seventh week an incision was made and the wires were removed. Union was found to be firm and the site of fracture was seen winding round the bone as a thin dark line. There was absolutely no thickening nor the slightest indication of any provisional or ensheathing callus. It is evident that in this case the callus which united the broken ends was between the bone surfaces and in the medullary cavity, because there was none external.

The exact approximation of the fragments in fractures of the base of the skull is the reason why callus is also lacking there.

The presence or absence of callus has a marked influence on the functional results obtained, especially in fractures in the vicinity of joints. If, as has been stated, callus is due to lack of proper approximation of the fragments, it is evident that if a joint is involved and the fragments are not approximated, we must expect limitation of motion. Limitation of motion due to this cause is almost insurmountable. The use of passive motion is usually of no avail, and healing progresses either with a resultant ankylosis or restricted motion. Repeatedly have I seen persistent passive motion practised much to the distress of the patient, with but little or no benefit resulting. It is in these cases that the X-ray is of service. Fractures which involve the joints not infrequently detach pieces of bone, which become more or less twisted out of their normal position, and later be-

come fixed, thus interfering with the motion of the joint. It is not a hopeful practice to endeavor to retain motion by passive movements calculated to push the fragments away; they cannot be displaced far enough to prevent their influencing the joint movements. The condition of affairs having been recognized by the X-ray, it is better to follow the advice of Roberts and others and pin the fragment in place, or deliberately cut down and replace it as it should be, retaining it with wire or other suture material, or even resect the joint.

The recognition of the uselessness of passive motion in overcoming limitation of movements in joints has caused some surgeons to advocate the treatment of fractures of the elbow without it until the splints have been removed and union has occurred.

If the fragments are in good approximation and the joint is kept quiet, the inflammatory effusion and callus is kept at its minimum, and the joint soon limbers up when restraint is once removed. Restoration of function can be hastened by baking the limb. The use of hot air, while serviceable in cases of fracture of healthy limbs, is deleterious in tubercular affections; hence in old cases the possibility of tubercular disease should be carefully excluded.

The question of passive motion is allied to that of massage.

I regret to say that, in spite of the attention of the profession having been directed to the use of massage in fractures many years ago, it still is not employed as much as it should be. This may be due partly to a distrust aroused by the extensive claims of some of its most ardent advocates, as Lucas Championnière and others.

Personally, while occupying a middle ground, the stand I take is none the less a positive one. I cannot follow those who treat fractures from the first by massage only without support. To my mind, the first principle in the treatment of fractures is that the two broken ends of the bone should be placed and held in as close approximation as possible. That this can be accomplished better with than without splints is at least my opinion. Even the ordinary movements of the body tend to disturb the

fragments, and unusual movements, such as one is constantly experiencing, disturb them still more. The fact that fractures, such as those of the patella, radius, etc., frequently unite with little or no support or protection, is no proof that they should not have been afforded both. There are few cases, indeed, where a fracture would not be benefited by a proper support skilfully applied. It need not always be elaborate; a fractured leg is sometimes best treated and most comfortable if allowed to rest for a day or two folded in a pillow. The use of splints is not incompatible with massage. As regards the time of its use, in many cases it can be commenced at once as soon as the fracture is seen. A light stroking "effleurage" of a recently injured limb need not cause pain, but rather be grateful to the patient, and tends to restore the circulation and promote the absorption of effusion. Its efficacy depends on the manner of its administration; anything approaching roughness is obviously unsuitable in cases of recent injury; and if real pain is experienced it is evidence that the massage is either unskilfully administered or that it is unsuitable to that case, and most likely the former.

It is true that there are some cases in which the local injury is so great in simple fractures that the treatment should be of the simplest character, such as the use of evaporating lotions; cases in which there is much bruising of the skin may be of this character. After the first reaction has passed, say in a couple of days, there is no longer any excuse for delaying massage. I regret to say that it is still too much the custom to use fixed dressings, which are allowed to remain on the part without removal for several weeks. This may promote the healing of the bones, but it does not tend to restore the soft parts to their normal functions. The worst effects of this treatment are seen in fractures of the leg. When the upper extremity is fractured, the patient rarely requires to be admitted to the hospital; but a fracture of the lower extremity interferes with locomotion, and consequently it is admitted for treatment in the wards. In order to make room for new patients, the temptation is great to put fractures of the leg up in plaster-of-Paris dressings and

allow the patient to leave the hospital on crutches. When, after
the lapse of several weeks, the plaster dressing is removed at the
out-patient department, it is usually found that, while the bones
themselves have united firmly in a fairly satisfactory position,
the leg and foot are swollen, œdematous, and stiff. The
slightest attempt at movement causes pain. If now the case is
left off and the patient allowed to go around, it is often weeks
or even months before the muscles, tendons, ligaments, and
soft tissues generally have become loosened sufficiently and re-
stored to their normal condition to allow of painless locomotion.
This is needless. Suppose the patient had remained in the hos-
pital and been treated with the old-fashioned fracture-box; and
that each morning the sides of the box had been lowered and
the soft parts gently massaged and, as healing progressed, the
joints gently moved, we would then by the time that union had
taken place have restored the normal condition of the soft parts
and the leg would be ready and in fit condition to resume its
functions. It is *prima facie* evidence of inefficient treatment
when one is compelled to institute an elaborate further course
of treatment to overcome effusion and stiffness after complete
union of the bone has taken place. The frequency of the
massage depends on the individual case. In some twice a week
will suffice, but in others daily massage is necessary. It is true
that to give fractures this amount of attention will consume
much time. This is so; but it is the only proper way to treat
fractures, and when not carried out results in delayed conva-
lescence and deprivation of the use of the injured member.

Limitation of movement may be the result either of dis-
placed fragments, as already alluded to, or to inflammation and
effusion in the soft parts. It is to this latter condition that
massage is particularly applicable.

The primary treatment given to fractures varies with dif-
ferent surgeons. Many have wet applications applied; lead
water and laudanum is a great favorite. Their importance
seems to me to be overrated. Some have a habit of applying
lead water to every case, and covering it with oiled silk or other
impervious material.

This can hardly be necessary.   Routine treatment is, and of necessity must be in many cases, bad treatment.   Individual cases vary.

One frequently encounters cases in which there is little or no displacement, and which undisturbed give the patient no pain.   What object is to be gained by wet applications in such cases is hard to see.   They can be rendered perfectly comfortable by applying a nicely adapted and padded splint with gentle compression by a neatly applied bandage.   Using a thin layer of cotton over the part under the bandage will be more acceptable than a moist dressing.

The use of wet dressings I am inclined to believe favors the formation of blebs by macerating the skin, and on that account are objectionable.   In some cases, where redness and pain are prominent, some soothing application is of advantage; and here occasionally some form of wet dressing is desirable, and seems to add to the comfort of the patient and to aid in allaying the inflammation.

A favorite application is lint or gauze moistened with equal parts of glycerin and water.   If the leg is the part involved, as is usually the case, the dressing is simply laid on its surface, and perhaps a light ice-cap added.   In many cases a plain towel laid on the limb with the ice-cap is all that is necessary.   No impervious covering is to be used.

The question of the extent to which it is desirable to use ambulatory dressings occupied the attention of the profession some years ago to a greater extent than it does at present. That it is possible to treat fractures even of the thigh with a certain degree of success without confining the patient to bed has been amply demonstrated, but the method, even as applied to fractures of the leg, has not been found desirable.   It is possible to do many things which it is inexpedient to do, and this is one of them.   In stating this, I do not mean to say that ambulatory dressings are never to be used.   On the contrary, the surgeon should be familiar with the method, so that when proper cases present themselves it may be utilized.

The method is only intended for use in fractures of the

lower extremity, and one of the objections to it is the swelling
and pain which arise when a recently fractured limb is placed
for any length of time in the upright position. In fractures of
the leg, when there is but little tendency to displacement, pa-
tients can, not infrequently, be induced to go around early in a
fixed dressing and crutches.

I have made quite extensive use of silicate of soda or
plaster dressings in which is incorporated a piece of strap iron
which passes down one side of the leg and up on the other,
being allowed to project about three inches beyond the sole.
With a high shoe on the opposite foot and crutches the patient
can go around with a considerable degree of safety. To make
an efficient ambulatory apparatus that can be removed for pur-
poses of massage entails considerable trouble, and the tempta-
tion is to allow the dressing to remain intact until consolidation
of the bones is completed. For these and other reasons the
method is only to be used in those cases in which it is im-
possible to retain the patient in the wards of the hospital, or
where for special considerations one is willing to devote an
unusual amount of time and trouble in order to obtain certain
desirable objects.

When the thigh is the bone involved, if the fracture in-
volves the shaft or upper extremity, the method is practically
undesirable.

In fractures low down near the condyles, particularly in
children, some form of orthopædic appliance, such as the hip
splint of Thomas or Taylor, can be successfully used; but chil-
dren are usually not pressed for time, and adults commonly
prefer the comforts of a bed to the discomforts of a splint and
crutches. Nevertheless, it is our duty to know what can be
done to enable patients to get around early; and, if the neces-
sity for an employment of the method arises, we should be able
to give our patients the benefit of the treatment.

A NEW OSTEOPLASTIC AMPUTATION AT THE ANKLE-JOINT.[1]

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OF NEW YORK,

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AT the very outset I would state that in the following remarks I shall not discuss those amputations in which a portion of the os calcis or astragalus can be preserved. No one who has had any experience with the Pirogoff amputation, or with any one of its numerous modifications, will or can deny that the ultimate results are simply ideal, and to my mind, at least, there can be no discussion nor improvement when an amputation of this nature can be performed. This operation, therefore, should be the operation of choice in all those cases in which the disease, or trauma for which the amputation is performed, lies distally to the tibiotarsal articulation, provided always, of course, that the os calcis is healthy, and that there is sufficient integument to cover the stump. There occur, however, a number of cases in which the provisions above stated do not exist, and recourse must be had either to an amputation higher up on the leg, or, in a few rarer instances, to the so-called Syme's amputation. It is particularly of this latter class that I wish to speak, as I believe I have devised a method which, while preserving all the good qualities of the Syme method, excludes all of its drawbacks and disadvantages.

At this place I shall not dilate upon the good qualities of the Syme stump, as they are well known to everybody; but its one disadvantage must be emphasized. Personally, I am absolutely convinced that, as far as function is concerned, a stump formed according to the method usually given for a Syme's

amputation must *eo ipso* be bad, because the distal extremity of the stump is formed by bone sawn transversely across. I am fully aware of the fact that I should hesitate to express myself so forcibly about a well-recognized and universally adopted method, but I have reason to believe that this drawback of the operation is not sufficiently appreciated.

In an article which appeared in the *Medical News* of February 9, 1901, and in which I referred particularly to the valuable studies of Bier, I have already stated fully the reasons of faulty stumps, and, just to recapitulate briefly, I would say, that an amputation stump can be good only if the distal extremity is covered, either by normal cartilage, as, for instance, in an exarticulation, or if the sawn surface is covered or sealed by normal bone, covered by normal periosteum, taken either from the bone amputated or from an adjoining bone. I believe this to be the fundamental principle and the *sine qua non* in the formation of all amputation stumps, and, provided, there were no contraindications, I have always been guided by this principle when performing an amputation on any part of the body. Everything else, as the shape of the stump, the form of the incision, the size of the stump, the skin or muscle covering the stump, is secondary, and must give way to the first requirement, provided it can be our aim at all to form a good, end-bearing stump. Let us now investigate an ordinary Syme stump, and see whether it will correspond to the above requirements, and if what I have said is true, then I trust you will also very readily agree with me that my remarks regarding the poor quality of the Syme stump are not too forcible.

In the original Syme's amputation both malleoli are sawed off, as well as a thin lamella of the tibia ; in other words, a sawn surface is exposed everywhere. It is true that both Syme and, since his time, others have modified the operation in so far that they have left in place the cartilage-covered surface of the distal extremity of the tibia, and have sawed off the malleoli only ; while from my stand-point the original operation was bad in all respects, the later modification was anatomically only half as bad, as it exposed a sawn surface only on two sides, but

functionally it was just as bad as the original amputation, because it could never form a good, end-bearing stump.

It is only lately that I discussed this point with a very skilful manufacturer of artificial protheses, and, contrary to my firm assertion, he insisted upon the superior qualities of the Syme stump, and offered to prove his statements by at least one end-bearing Syme stump. Subsequently, he gave me an op-

FIG. I.
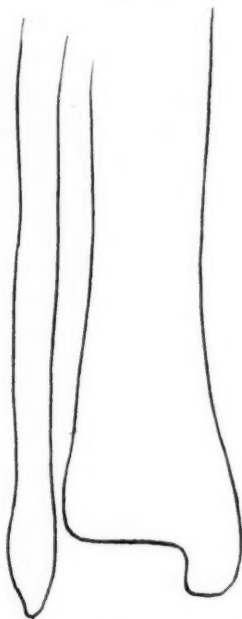
Diagram of tibia and fibula after exarticulation of the foot.

portunity to examine this stump, and on investigation, it is true, I found an end-bearing stump, which, however, proved to be not a Syme but a Pirogoff. I am also compelled to exclude those occasionally seen stumps, which are formed by a true exarticulation of the foot, without interfering in any way with the malleoli; these, as I have pointed out, must be, like all ex-articulations, perfect stumps; but this method of operation is only rarely indicated, and is not a Syme's amputation.

The question, therefore, was how to amputate the foot at the ankle-joint, and yet leave nowhere the sawn surface of any bone. I have solved the question in the following manner:

The cutaneous incision is made in such manner and such place that we can obtain ample, healthy skin for covering the stump; if there is any choice, it is preferable, of course, to carry the incision in such a manner that the resulting cicatrix

FIG. 2.

Diagram showing portions of bone to be excised.

will not come to lie directly on the end of the stump; and of these two preferably anteriorly, because then the integument covering the stump will be formed out of the thick heavy skin forming the heel; but on no account should the length of the stump be sacrificed for the heel-flap.

After retraction of the skin there follows a rapid **exarticu-** lation of the foot at the ankle-joint; this exposes the **two**

malleoli and the contiguous portion of the tibia covered by its cartilage.

An irregular octohedra-shaped piece of bone is now sawn out of the fibula in the following manner. The saw enters the fibula on the inner side, approximately on the level of the cartilage covering the tibia, and is carried obliquely upward and outward for a distance of about one and one-half centimetres to within one or two millimetres of the external surface of the

Fig. 3.
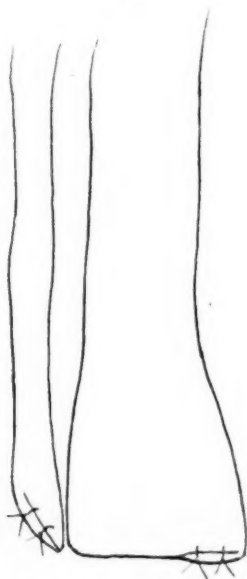
Diagram of stump after suturing the two osteoperiosteal flaps.

fibula; the saw is now withdrawn and made to enter the external surface of the fibula, also at the level of the cartilage covering the tibia, and is then carried mainly upward, but with a slight deviation inward, until it meets the end of the first saw-cut, thereby preparing a small osteoperiosteal flap from the outer surface of the fibula, which can be readily fractured and deflected temporarily outward. The portion of bone removed has the shape of an irregular octohedron; one apex of this is at

the tip of the malleolus, the other one is at the junction of the
two sawn surfaces, while the two lateral borders are on the
external and internal surfaces of the fibula, on a level with the
cartilage covering the tibia. The two sawn surfaces are now
approximated and fastened by catgut sutures, which pass
through the periosteum covering the parts. (See diagram.)

We now turn our attention to the tibia. As is well known,
the internal malleolus is shorter and thicker; the procedure has
to be varied somewhat therefore. The saw enters the inferior
surface of the malleolus about two millimetres from its internal
surface, and is carried in an upward direction up to the level of
the cartilage covering the tibia; this forms a small osteoperios-
teal flap from the inner surface of the malleolus, which is tem-
porarily deflected inward. The remaining portion of the mal-
leolus is now removed with a saw, also on a level with the
cartilaginous surface. The two sawn surfaces are now ap-
proximated and held in place by means of catgut sutures, which
pass through the periosteum covering the parts. (See dia-
grams.)

Let me emphasize by stating once more that the good quali-
ties of a stump depend entirely and absolutely only upon the
bone; and in order to have these qualities, the end of the bone
must be covered either by its normal cartilage, or by bone cov-
ered by its normal periosteum. Let us now look at the com-
position of the stump made by the method outlined above; if
properly made, we will find a broad stump divisible into three
surfaces, viz., a small inner one, and a smaller outer one, cov-
ered by normal bone and periosteum, and a larger central one,
covered by normal cartilage; all in all, we find all the require-
ments present for the formation of a perfect, end-bearing stump.

The final step consists of accurate hæmostasis, followed by
suturing of the skin, after the introduction of suitable drainage,
if indicated.

The feasibility of this operation occurred to me some five
years ago, when I first began to perform amputations by osteo-
plastic methods, but not until the past year did a suitable case

offer itself for a trial. Following is a brief extract from the history of the case:

J. K., a miner by occupation, and twenty-three years of age, injured his left foot on February 28, 1903, by a block of coal falling upon it; the injury crushed the tarsus and metatarsus, and the subsequent sloughing caused an extensive loss of the integument and subcutaneous tissues, involving both the dorsum and planta pedis, from near the ankle-joint almost to the toes. He was admitted to Mount Sinai Hospital on September 27, 1903, at which time the following condition was found. The left foot was in a position of pes equinus. The integument of most of the dorsal and plantar surfaces of the foot was destroyed and replaced by a mass of scar tissue, densely adherent to all the underlying bones; a large irregular ulcer occupied the heel and lateral portions of the foot. With this local condition an amputation was the only remedy, and its performance was relegated to me by Dr. Arpad G. Gerster, in whose service the case was.

Operation, October 2, 1903. The incision was absolutely irregular in outline, owing to the encroachment of the ulcerated surface into the seat of the operation. In other respects the operation was performed exactly according to the method outlined above. Primary union resulted, with the exception of a small sinus, which continued to secrete for a long time an aseptic synovial fluid. This persisted for so long a time that on December 7 the sinus was enlarged, and the synovial membrane covering the cartilage was scarified and some of the lateral margins curetted. The ultimate closure of the wound was therefore protracted, but finally patient was discharged perfectly cured on January 17, 1904.

Accompanying skiagraph (Fig. 4), taken five weeks after operation, shows firm union of the two osteoperiosteal flaps. The stump resulting from the operation was perfect in all respects; the patient could walk upon it on the bare floor without the least protection, and no amount of pressure could elicit the slightest pain in it. He now wears a prothesis which is only about two inches higher than an ordinary shoe; walks only with an indication of lameness, and has returned to his rather arduous work as a miner.

Fig. 4.—Skiagraph of stump.

It might, and with propriety, be argued that I assume great privileges to recommend an operation which I have personally tested but once; in reply to this I can only say that in the case tried the ultimate result, as far as function, etc., is concerned, was absolutely perfect in all details, and that for theoretical, but nevertheless fully tried reasons in other amputations, this modification of amputations at the ankle-joint is and must be perfect.

SOME OBSERVATIONS ON THE EFFECTS PRO-DUCED ON THE SKIN BY THE DIS-CHARGE OF SMALL-ARMS LOADED WITH SMOKELESS POWDER.[1]

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THE effects upon the skin produced by the discharge of small-arms loaded with black gunpowder at close range have often been studied.

The subject is of especial interest from a medicolegal point of view. Not all the grains of black powder in the charge are burned in the barrel of the weapon, and the unburned grains or partly burned grains are propelled with some force for a distance of several feet.

If these strike the human skin or the clothing certain effects will be produced, which will vary according to the weapon used, the size of the powder charge, and the distance of the muzzle from the skin or the clothing, as the case may be.

With a given weapon and a given charge of powder, it may be possible to determine from the character of these effects whether a shot has been fired within a certain distance or not. The important bearing of such data upon the judicial verdict in certain cases of murder or suicide is obvious, and evidence so derived has in many instances been of great use in the furtherance of justice.

The effects produced by black powder upon the skin are in the nature of tattoo marks, that is to say, the grains of powder are driven into the substance of the skin. The area thus marked increases with the distance at which the shot was fired,

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798

whereas the number of grains embedded diminishes with the distance. Such tattooing may, it is said, occur at a distance of at least ten feet.

The hair of the scalp may be singed at a distance of three feet by the discharge of an ordinary .32-caliber revolver.

Clothing may be scorched by the discharge at a distance of several feet, and at a range of a foot or less linen may be set on fire.

The effects of black powder, then, are obvious and, within certain limits, fairly definite.

It occurred to me that some experiments to determine whether other or similar effects were produced by the discharge of pistols loaded with smokeless powder might not be devoid of interest.

There are at present several kinds of pistols on the market using smokeless ammunition exclusively. It seems therefore not improbable that in the future homicides and suicides will largely be committed with weapons using ammunition of this class.

Smokeless powders have gun-cotton as a basis, to which is sometimes added a small amount of nitroglycerin, or one or more of a large number of ingredients both organic and inorganic. The purpose of these additions is to modify the character of the ignition or of the explosion, or to give the powder a distinctive color or to make it waterproof. The grains of such powders are usually small and of various shapes.

The explosion of black powder gives on the average 65 per cent. solid residue and 35 per cent. of usable gases. Smokeless powders give on the other hand nearly 70 per cent. of usable gases and 30 per cent. of solid residue.

Smokeless powder is at least twice the strength of black powder weight for weight; some kinds are much stronger. Accordingly, the amount of residue of smokeless powder driven from the gun is much less than is the case with black. The combustion of smokeless powders is, in other words, much more complete.

The circumstances under which my experiments were con-

ducted led me to omit, for prudential reasons, the use of high-powered rifles, and to use only pistols and a shotgun.   Through the kindness of Dr. J. C. Ayer, I was able to experiment with four pistols,—Colt's automatic pistol, caliber .32; Colt's automatic pistol, caliber .38; the Luger automatic pistol, caliber 7.65 millimeters; the Mauser repeating pistol, caliber 7.63 millimetres: these latter two are of German manufacture.

For comparison, a black powder .32-caliber Hopkins and Allen revolver was used, firing Smith and Wesson ammunition.

The shotgun used was a 12-gauge Parker gun, what is known as a close shooting-gun.

For the purpose of testing the effects of the discharges upon the skin, the body of a medium-sized man was procured. The cadaver was quite recent, the skin showed no signs of decomposition, the muscles felt quite firm.   Rigor mortis was absent.

In addition to notes on the effect produced upon the skin, some observations were made on the penetration of the different pistols.   Lastly, a number of shots were fired from a shotgun to determine the character of the wounds produced at different ranges.

SHOT 1.—Colt's automatic pistol, caliber, .32 inch.; smokeless powder; charge, four grains Walsrode powder; bullet, lead, full copper mantle; weight, seventy-six grains.   Distance of muzzle of pistol from skin two inches.   Shot fired at the side of the head in front of the ear, skin covered with short hair.   The hair was not singed.   The skin was not burned.   A few grains of a dark gray residue were found upon the hair and upon the skin over an area one inch in diameter surrounding the bullet wound. These grains were readily wiped off with a dry cloth, leaving no visible mark behind.

The wound of entrance in the scalp was a small, circular orifice one-sixteenth of an inch in diameter.   There was no discoloration of the edges apparent, nor were the edges frayed.

The wound at the point of entrance in the skull was found to be a round hole through the bone about the diameter of the bullet.

The wound of exit from the scalp upon the opposite side of the head back of the ear was a mere slit in the skin one-fourth of an inch in length.

The wound of exit from the skull was a round hole about the diameter of the bullet.   The bullet failed to penetrate the barrel of sand used as a backing, and was picked up off the floor but slightly deformed.

Fig. 1.—Three shots. From before backward. .32, black powder. .38, Colt, smokeless. .32, Colt, smokeless.
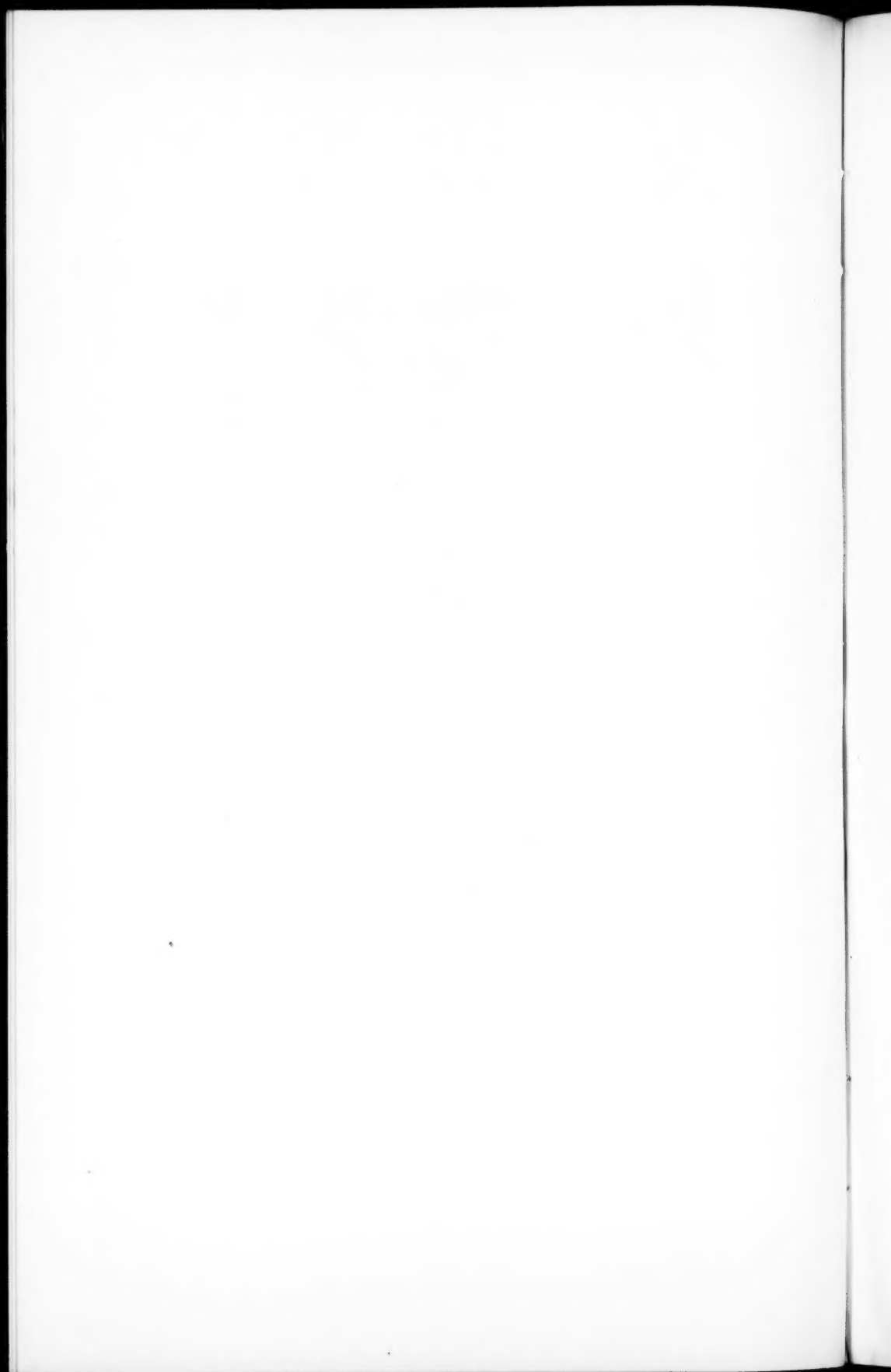
SHOT 2.—Colt's automatic pistol, .38-caliber; soft-nosed copper jacketed leaden bullet, smokeless powder (seven grains Walsrode?); bullet. 130 grains. Was fired into temporal region of the skull at a distance of two inches. Wound of entrance a round orifice in the skin one-eighth of an inch in diameter. Edges of wound slightly contused. A few faint lead-colored stains upon the skin surrounding the wound. These specks appear to be embedded in the skin, and cannot be removed by rubbing with a wet cloth. The hole of entrance through the skull is round and about the diameter of the bullet.

The wound of exit in the skin upon the opposite side of the head is an irregular tear about one inch in length, with radiating slits along its border. Brain substance escaped freely from this orifice as well as from the external auditory canal on the same side of the head. Palpation of the skull showed a comminuted fracture surrounding the wound of exit. The comminution of the skull extended over an area three inches in diameter in the temporal and parietal regions. There was doubtless also present an extensive fracture of the base of the skull. After leaving the head, the bullet buried itself in a barrel of sand.

SHOT 3.—For purposes of comparison, a shot was now fired from a Hopkins and Allen revolver, caliber, .32 inch.; Smith and Wesson ammunition; black powder, ten grains, soft lead bullet. The shot was fired into the temporal region with the muzzle of the pistol three inches from the scalp.

The hair was singed, the scalp was burned and tattooed with powder grains, so that the skin was black over an area one and one-half inches in diameter. The wound of entrance in the skin was one-eighth of an inch in diameter, the edges were slightly contused and stained lead color. The hole in the skull was about the diameter of the bullet. Bullet lodged.

Photograph No. 1 is a picture of these three shots. From before backward. 1, .32, black powder; 2, .38, Colt, smokeless; 3, .32, Colt. smokeless.

SHOT 4.—Luger automatic pistol, 7.65 millimetres caliber; steel jacketed bullet. Jacket incomplete over a small circular area at the point of bullet where the lead interior is exposed. Powder charge, five grains, smokeless.

Shot fired into the cheek over malar bone backward, downward, and inward. Distance, three inches. No powder marks upon the skin. Orifice of entrance three-sixteenths of an inch in diameter and circular. Edges slightly contused and white in color. Bullet lodged.

SHOT 5.—Mauser automatic pistol, caliber, 7.63 millimetres; steel jacketed bullet. Shot fired at outer aspect of upper third of right thigh. Distance of muzzle of pistol from skin three and one-half inches. Powder stain one inch in diameter. A grayish smudge upon the skin without deposition of distinct grains.

Wound of entrance circular, three-sixteenths of an inch in diameter. Edges slightly contused, white in color; wound of exit on inner surface of limb, oval, three-sixteenths of an inch in diameter, slightly ragged. Wound of entrance on inner aspect of left thigh the same. Wound of exit on

outer aspect the same. The bullet then passed through the distal phalanx of left thumb and entered the barrel of sand.

Although the bullet passed through the centre of both limbs, neither femur was fractured.

SHOT 6.—Mauser pistol. Fired into upper third of right thigh at a distance of one foot from the skin. Full jacketed bullet.

A few black specks or grains are adherent to the skin around the wound over an area three inches in diameter. These are readily wiped off with a dry cloth. The bullet caused a fracture of the right femur, and passed across the body in a slightly upward direction, and was found under the skin just above the left great trochanter. The bullet was somewhat deformed as shown.

SHOT 7.—Hopkins and Allen, .32 caliber; Smith and Wesson black powder ammunition. Fired at outer aspect of right thigh; distance, one foot. Skin tattooed with powder grains too numerous to count over an area three and one-half inches in diameter. Wound of entrance circular, three-sixteenths of an inch in diameter; edges stained with lead. Bullet lodged.

Inasmuch as the changes produced in the skin by the smokeless powders were found to be so slight even at very short distances, it was thought useless to fire shots at greater ranges.

The only shots producing stains which could not be wiped away were the Colt .38, which produced a small and barely perceptible smudge upon the scalp at a distance of three inches, and the Mauser pistol, which produced a slightly more perceptible smudge at the same distance. At one foot none of the shots left any permanent powder marks upon the skin.

Photograph No. 2 is a picture of two shots fired into the thigh with the Mauser pistol at one foot, and three inches, respectively.

Photograph No. 3 is a picture intended to show the different effects of a .32-caliber revolver loaded with black powder, and the Mauser pistol loaded with smokeless powder, each at a distance of one foot.

Some shots were then fired with a 12 gauge Parker shotgun, loaded with bird-shot and smokeless powders, to determine the character of the wounds produced at different distances, more especially to note how far the charge of shot continued to act wholly or in part as a single missile.

The subject was suspended by the head in the erect posture and all the shots but one were fired from in front. The thickness of the body through the abdomen from before backward was eight and one-half inches.
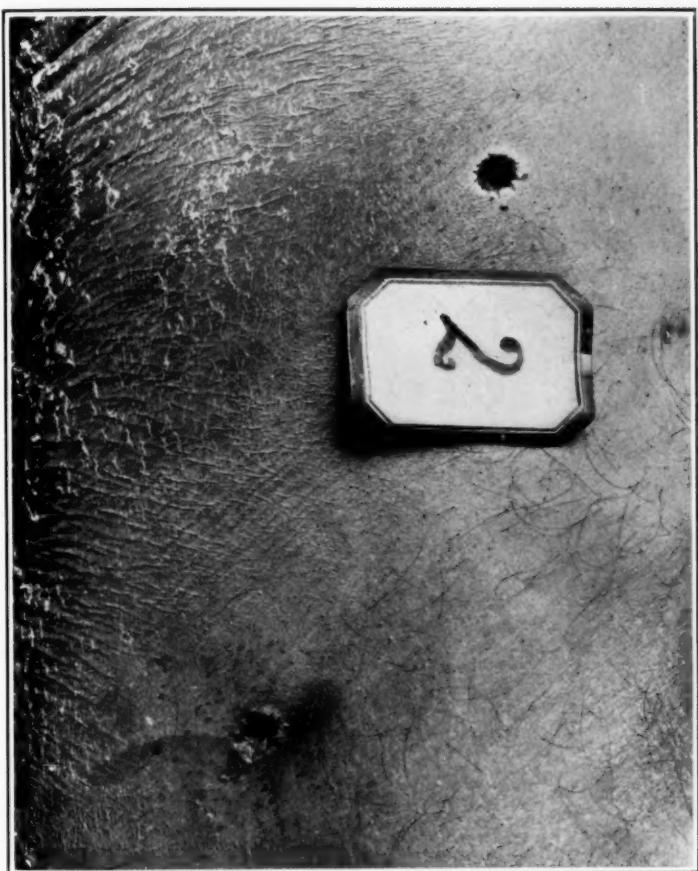
FIG. 2.—Two shots fired into the thigh with the Mauser pistol at one foot, and three inches, respectively.
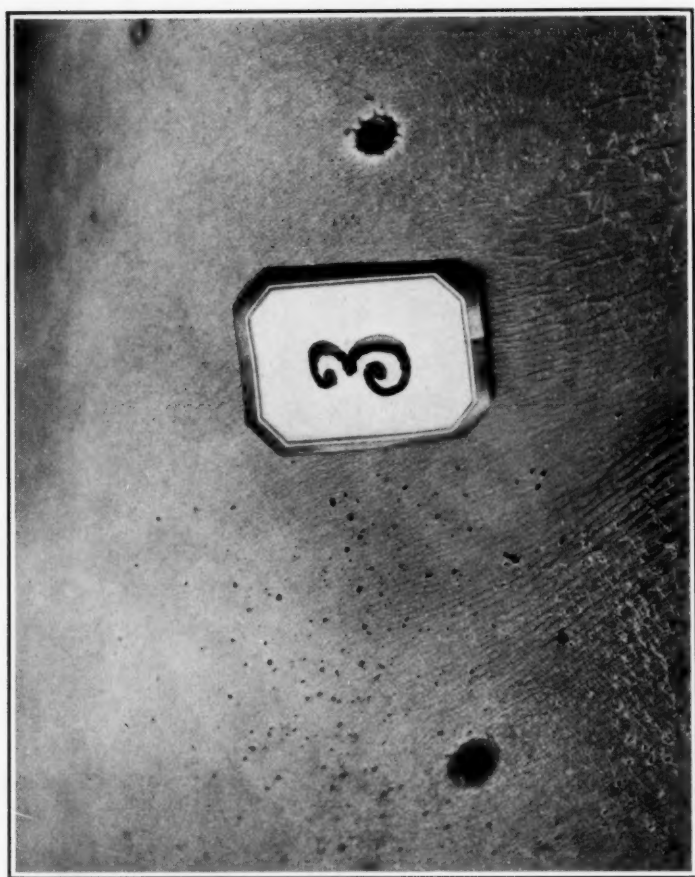
FIG. 3.—32 caliber revolver, black powder, at one foot, showing tattoo marks. Mauser pistol, smokeless powder, at one foot; absence of tattoo marks.

SHOT 1.—Shell loaded with thirty-seven grains Dupont smokeless powder, said to be the equivalent of three drachms of black powder, one and one-eighth ounce No. 4 shot. Shot fired at the umbilical region. Distance, eighteen feet. Spread of shot, three and one-half inches. In the centre a ragged hole two inches in diameter was tòrn through the abdominal wall. There is a distinct bulging in the back, forming a soft tumor nearly in the middle line, and individual shot can be felt embedded in the skin of the back over this area.

SHOT 2.—Same load; distance, thirty-five feet. Shot fired at epigastrium. Spread of shot over an area seven inches in diameter. Shot wounds discrete, except in the centre, where there is a ragged hole one inch in diameter through the abdominal wall. In this hole there lies embedded a powder wad. Shot did not emerge from back.

SHOT 3.—Cartridge loaded with twenty-four grains Ballistite smokeless powder; said to be equivalent to two and three-fourths drachms of back powder; one and one-eighth ounce No. 9 shot; distance, eighteen feet.

Shot fired at lower part of abdominal wall on the left of median line. Spread of shot six by six inches. There is a ragged hole through the abdominal wall one and one-half inches in diameter, and a soft bulging tumor just above the crest of the ilium behind.

SHOT 4.—Load, new Schultze powder; thirty-nine grains, equivalent to three drachms of black powder. One and one-eighth ounces No. 7½ shot—what is known as a pigeon load.

Shot fired at the thoracic wall near the nipple; distance, eighteen feet. Spread of shot over an area six inches in diameter. A ragged hole one and one-half inches in diameter in the thoracic wall. A good many of the shot passed through the thorax emerged from the back and embedded themselves in the barrel-staves behind.

SHOT 5.—A shot was then fired through the thorax at a distance of six feet, from behind. There were no powder marks on the skin. The wound of entrance was but little larger than the caliber of the gun. The wound of exit was a slit three inches in length. Nearly the entire charge went through the thorax and embedded itself in the barrel behind, including a powder wad which was found wedged in between the barrel hoops. Fragments of lung and heart tissue were plastered on the barrel, and the wall of the room was extensively splattered with the same material.

While we all have realized from experience that a shot-gun fired at close range produced great destruction of tissue, it was to me at least a surprise to find that at so great a range as thirty-five feet a considerable part of the shot held together sufficiently to produce the effect of a single missile.

Even at a distance of eighteen feet I should not have expected such a destructive effect from a charge of fine bird-shot.

A number of pistol-shots were then fired with a linen hand-

kerchief as a target; a piece of woollen cloth was then used, and then some squares of cardboard. The distances were three inches, and one foot.

It is to be noted that the smokeless powders produced only very slight discolorations of the linen cloth even when fired at a distance of three inches; upon woollen cloth no effect was produced appreciable by the eye, except a faint dark stain around the edge of the bullet hole. Some differences are to be noted between the effects produced on linen by the Colt's and the two German pistols.

The Colt cartridges are loaded with a green granular powder, probably Walsrode. This powder produces a faint speckled discoloration, which when examined closely is found to consist of a moderate number of rather large, brownish-black grains, adherent to but not deeply embedded among the fibres of the flax. No scorching effect can be detected. Under a microscope, these grains resemble the fused masses of slag from a smelting furnace.

The Mauser and Luger pistols are loaded with a powder which consists of thin squares of a dark grayish-black color, evidently cut from a sheet of the material from which the powder is made. I have been unable to learn the name of this powder, but it closely resembles the powder known as Ballistite in appearance, although the squares are smaller. These powders produced a faint grayish smudge upon the linen cloth at a distance of three inches. No distinct grains can be distinguished with the naked eye.

Under the microscope the discoloration is seen to consist of numerous fine black angular grains embedded among the meshes of the flax fibres; the grains are about equal in diameter to a single fibre of flax, and their distribution is quite different from that noted with Walsrode powder; the grains are also much smaller and more numerous.

The changes produced in linen by black powder are quite different.

At a distance of three inches the cloth was set on fire around the margin of the bullet hole. The cloth was scorched

and discolored over an area more than three inches in diameter, and numerous powder-grain marks are scattered over the scorched area. Under the microscope these marks are found to be due to the presence of a large amount of brownish-black granular material plastered on the surface of the flax bundles. The scorching of separate bundles of fibres is also quite evident.

When fired at cardboard the same differences are to be noted between black and smokeless powders. The black powder causes scorching of the paper at very short distances (three inches), together with numerous marks of powder grains driven into the paper. At the distance of one foot the scorching is absent, but the powder grains are still very numerous and black. The smokeless powders fired at three inches cause slight smudging of the paper and numerous little indentations of the surface of a gray color .

The Mauser cartridges cause more discoloration of the paper and fewer indentations than the Colt.

At a distance of one foot the Mauser produces scarcely any perceptible mark, and the Colt produces a few slight indentations and no discolorations.

Although these experiments are few in number and by no means complete, a few conclusions may I think be drawn from them.

1. Powder marks upon the skin and clothing produced by smokeless powder are much less distinct and definite than those caused by black powder.

2. With the weapons used in these experiments, such marks cease to be produced when the distance exceeds one foot and the shot is fired at the naked skin.

3. At a distance of three inches or less powder marks may be present, but they will always be faint, and may in many instances be wiped away from the skin with a wet or dry cloth.

4. If the shot be fired at a part of the body covered with clothing, no powder marks at all will be found upon the skin. The clothing will never be scorched, no matter how near the weapon is held. .

If the clothing be wool, no powder mark is likely to be

detected upon it even at the closest range, unless under the microscope. If the clothing be of linen, a faint mark may be found upon it if the weapon were held at a distance of three or four inches or less. If the distance much exceeded this no mark would be produced.

The evidence furnished by a microscopic examination of the pieces of linen appears to me to be quite interesting.

It is evident that by this means it might in certain instances be possible to state with some positiveness that a certain kind of ammunition had or had not been used.

Such a conclusion might be of the greatest importance from a medicolegal stand-point.

Further experiments of this character with many different varieties of powder would, I think, be worth while.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, January 13, 1904.

The President, HOWARD LILIENTHAL, M.D., in the Chair.

COMPLETE EXCISION OF SCAPULA FOR SARCOMA.

DR. LILIENTHAL presented a young girl who had been shown at two previous meetings of the Society. Less than a year ago she developed a round-celled sarcoma of the scapula, which was first treated by means of the X-rays and injections of Coley's fluid. As a result of this treatment there was temporary improvement, followed by a sudden increase in the size of the tumor, and without further delay the entire scapula was excised, leaving only the glenoid cavity. Both the wing and spine of the bone were found to be involved by the sarcomatous process. The wound healed by first intention, and the immediate functional result was excellent. For several months after the operation the injections of Coley's fluid were continued, and subsequently the patient was kept under careful observation. About six weeks ago a soft, movable mass, about the size of a hickory-nut, was felt in the stump of the scapula. This was removed, and proved to be a soft mass directly connected with the bone. The latter was thereupon removed, completing the total excision of the scapula.

Dr. Lilienthal said the case illustrated the importance of very complete excision in cases where bony tissue was invaded. Another interesting feature was the excellent functional result in a case where the entire scapula had been removed so recently. The patient had very good use of the arm, and its function was constantly improving. The speaker thought this might be due to the fact that the operation had been done in two stages.

SUPRAPUBIC PARTIAL PROSTATECTOMY.

DR. F. TILDEN BROWN reported the history of a man, sixty-seven years of age, who was first seen by him in October, 1902. The man was in excellent general health, but for five years had had increasing difficulty in urination, characterized by moderate frequency, always tardiness in starting stream, dribbling, and sense of unemptied bladder at termination. On a few occasions of retention and for examination purposes, different doctors have passed a catheter. Residuum after urination has been from five to ten ounces. On one occasion of retention used catheter himself.

Physical Examination.—Heart negative. Vessel walls slightly thickened. After passing four ounces of clear urine, an easily introduced rubber catheter finds twelve ounces residuum at nine and one-fourth inches urinary distance. Kidney excretions normal, excepting for moderate polyuria.

Rectal examination shows a half-lemon sized prostate. Slight median furrow discernible. Both lobes of uniformly firm, elastic consistency. The right noticeably the larger. Cystoscopy revealed an intravesical collarette, only interrupted by a fissure between the median and smaller left lateral lobes. No cystitis.

Suprapubic operation in September. Gas and ether anæsthesia. Moderate Trendelenburg posture. The sheath of the operator's cystoscope, carrying a cold lamp, was passed through the urethra to the bladder. This was used first for irrigation purpose, then for vesical distention before opening the viscus above, and during the remainder of the operation as the source of illumination for the surgical field. The then protruding prostatic lobes, with a moderate fissure between the median and left lateral, resembled a large cervix uteri with a unilateral laceration.

A vertical incision was made with a galvanocautery knife through the mucosa over the larger right lobe, which, with the median, was then enucleated. The presence of the cystoscope in the urethra served to gauge the intervening urethral wall. The left and smaller lobe was not removed, on the ground that by itself no barrier to urination would result, and that any needless traumatism should be avoided.

Bladder drainage was provided for by two small, soft, rubber-angled catheters conjoined at their lateral eyes by a silk

stitch; one led out through the urethra, the other through the suprapubic wound. This simple means was always effective in keeping dressings and bed perfectly dry. When the vesical wound, which had been sutured in the greater part, was ready to close, the catheters were freed by severing their connecting stitch with delicate scissors through the suprapubic wound. The short-angled catheter was then left in the urethra a few days longer. The patient made practically an uninterrupted recovery and left the hospital on the twenty-fourth day after operation. At this time there were between one and two drachms of residual urine. The urinary distance changed from nine and one-fourth inches to seven and three-fourths. The urine was passed in a continuous, forceful stream such as the patient likened to that of his youth. Subsequent examination has never found more than a drachm of residuum. Moderate polyuria persists, and he gets up twice at night for urination.

PERINEAL GALVANOCAUTERY PROSTATOTOMY.

DR. BROWN presented a man, aged seventy-nine years. A well-preserved, vigorous old man except for the exhaustion and depression due to a recently increasing obstructive cystitis. At twenty-two had urethritis; at fifty-five, pneumonia.

About two years ago he began to have frequency of urination; this was gradually augmented and pain became associated. When first seen, in April, 1903, he was obliged to urinate every half-hour night and day. Restful nights were impossible, but he continued to go to business daily. Urine was that of marked acid cystitis. Tuberculosis was excluded. Residual urine was between four and six ounces. Urinary distance, eight and one-half inches. Rectal examination showed prostatic enlargement of triangular shape, laterally. Right lobe two by one and one-fourth inches; left lobe one and three-fourths by three-fourths inches. Interlobular furrow distinct. No nodules. Uniform consistency. Cystoscopy revealed only a moderate intravesical projection of the lateral lobes, but a fairly prominent elevated lip stretching between them. Vesical mucosa showed a high grade of chronic cystitis.

Brief local and systemic treatment was attended with considerable improvement. Patient was not seen then for six weeks. On his return, the former distressing symptoms had recurred.

Against his inclination, he consented to go to the hospital for proper attention and observation; a few days of the latter convinced the speaker that some form of operative interference was indicated. Because of his age and marked mental and physical depression, as well as the high bladder floor and the perineal drainage which his cystitis required, Chetwood's operation appeared to be indicated in preference to perineal prostatectomy. This was done with Dr. Chetwood's valuable assistance on September 3, under gas and ether anæsthesia, the patient being in the lithotomy posture. Through an incision entering the membranous urethra the galvanocautery incisor was passed into the bladder. The Chetwood technique was then carried out on eacn lateral lobe and on the intervening lip or bar. Thereby the floor of the bladder was appreciably lowered. A large, soft rubber perineal catheter was left in the wound until the end of the fourth dav. Except for some mental aberration lasting three days, the patient made an uneventful convalescence.

Urine ceased to come through the perineal sinus by the twenty-first day. Urinary intervals were dailv increasing and amount of residuum decreasing, so that at the time of his leaving the hospital on the twenty-seventh day after operation this was practically *nil*. The urine then still showed a decided cystitis. At the present time he has regained a degree of health such as he had not known for three years. His urinary intervals are now from four to five hours. There is no residuum whatever. The urine still shows, and probably always will, a colon bacillus cystitis, but with the removal of obstruction it is practically symptomless.

Dr. L. W. HOTCHKISS asked Dr. Brown whether he regarded the suprapubic operation on the prostate as a more dangerous procedure *per se* than the perineal method? The question had excited much controversy, and was still, apparently, unsettled. The suprapubic route gave the operator an excellent command of the bladder, and seemed to be the more natural method of entering it, providing, of course, there were no special contraindications.

Dr. BROWN, in reply to Dr. Hotchkiss, said his experience with perineal prostatectomy was rather limited. He thought that a freer access to the field could be gained by the suprapubic route, and he was always pleased when there was some element about the case which enabled him to see a possible advantage for the suprapubic operation, in contradistinction to the perineal. The

wonderfully rational technique of the method of perineal prosta-
tectomy that had recently been brought before the profession by
Dr. Young had appealed to him, however, both from an anatomi-
cal and physiological stand-point, and consequently his first pre-
judices against this route would in the future be greatly mini-
mized.

Dr. LILIENTHAL said he had had considerable experience
with suprapubic prostatectomy, and he saw no good reason why
he should substitute any other method. He regarded suprapubic
prostatectomy as a safe surgical procedure when compared with
other similar operations in that region. The method afforded an
opportunity of examining the bladder; it rendered possible the
removal of encysted stones which could not be removed from
below, and at times revealed the presence of a diverticulum or
tumor which might otherwise have remained undiscovered. In
short, it was beyond question the most surgical method of gain-
ing access to the bladder. With a suprapubic wound for removing
the enlarged prostate, he did not think it necessary to make an
additional opening through the perineum for the purpose of drain-
age or anything else. The latter was often more difficult to close
than the upper wound. All things considered, he thought it better
to leave the bladder wound open, and not make any effort to
hasten its closure by suture. In his last case, the suprapubic
wound had closed entirely in two weeks, and the patient passed
all his urine through the natural passages. In another case he
had in mind the wound had closed entirely, and the patient left
the hospital in fifteen or sixteen days after the operation. In
neither case had any attempt been made to suture the wound in
the bladder. His method of opening the bladder was as follows:
it was first merely punctured, and then the opening was enlarged
by inserting a dressing forceps; this did not actually tear the
walls of the bladder, but merely separated them, and they readily
recontracted.

Dr. Lilienthal said he was glad to observe that some of the
more progressive men had come out squarely in favor of supra-
pubic prostatectomy. In the January (1904) issue of the ANNALS
OF SURGERY, Moynihan, of Leeds, reported twelve cases he had
done by the suprapubic method, of which he thoroughly approved.
In his article the writer mentioned that in doing the suprapubic
operation there was a likelihood of tearing out a part of the pros-

tatic urethra. Dr. Lilienthal said he did not think that accident would occur if the work was not done too hurriedly. It could be avoided by good surgery, and even if the accident did occur it would probably not result in stricture, as the prostatic urethra was of so great a caliber that a section of it could be sacrificed without much harm.

Dr. Brown, in reply to a question as to whether he would again resort to perineal prostatectomy by the Chetwood method in a similar case, said that he would. The patient was an old man, in a very feeble condition as the result of his continued urinary suffering. It was very doubtful whether he could have withstood a prostatectomy. His mental symptoms after the milder operation would probably have appeared in an aggravated form after a severe operation. He was, in short, on the border-line, where any additional strain might have resulted in a fatal issue.

In a more recent case, Dr. Brown said, he had been induced, against his better judgment, to do a perineal prostatotomy by the same method in a case where either a suprapubic or perineal pros-tatectomy was indicated, but refused by the patient. The result, up to the present time, had not been very encouraging.* This was possibly due, the speaker said, to his inexperience with the Chet-wood instrument or to the brief time since the operation, the patient not yet being out of bed.

### EPITHELIOMA OF CHEEK: EXCISION AND PLASTIC OPERATION.

Dr. Irving S. Haynes presented a man, thirty-six years old, with a negative personal and family history, who about a year ago developed an epithelioma of the interior of the left cheek. It measured about an inch and one-half from before backward, and involved practically the entire thickness of the cheek. The lesion was excised, and the gap left in the cheek was closed by the fol-lowing plastic operation: A tongue-shaped flap was carried up from the neck and inverted, so that its external surface corre-sponded to the former mucous surface of the cheek. This flap was sutured to the gum above and below, and took very readily.

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* Since the above remark, the results now noted, ten days later, justify its retraction, catheter tests showing improvement.

FIG. 2.—Epithelioma of cheek.   Excision.   Result of plastic operation.
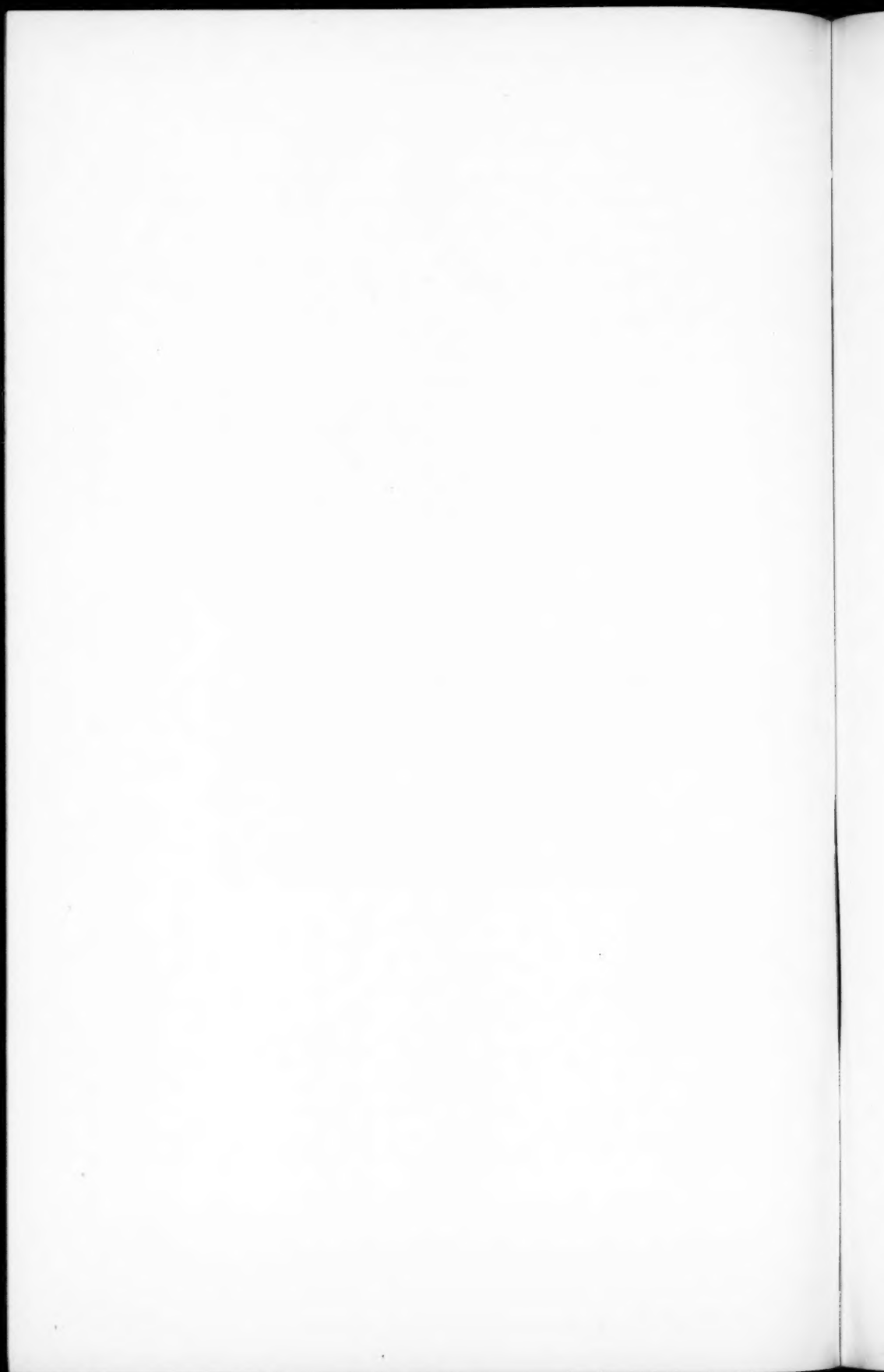
A second flap was then carried up from the neck, and, without inverting it, it was placed so as to cover the outer raw surface of the first flap. After two weeks the base of the inverted flap was excised and turned downward, partially covering the denuded area left from the first operation. All the wounds healed without complication, with the exception of a slight infection, which was probably due to the too energetic use of Balsam of Peru for the purpose of hastening granulation.

Dr. Haynes said that the hairs on the inner surface of the first flap had grown somewhat since the operation, but its surface was beginning to assume the appearance of mucous membrane. The opening into the mouth which had existed until now along the base of this inverted flap was closed.

FIG. 1.
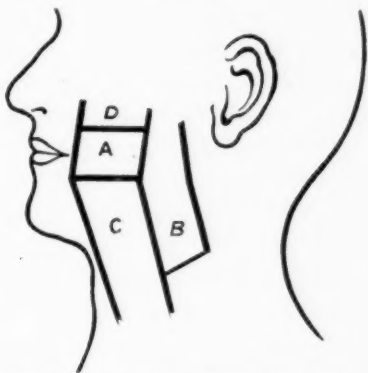
Plastic operation to reform cheek. *A*, Quadrilateral area involving entire cheek excised; *B*, Flap turned into mouth to replace mucous membrane; left attached by its base until union was secured; *C*, Flap slid upward and *D* flap slid downward to cover the raw surface of *B*.

Healing was rapid and the wounds closed, giving a good result without leakage. The diagram shows the direction of the incisions, and the photograph (Fig. 2) the appearance at the time of his discharge. The dark area below the lobe of the ear is a small granulating area, left by raising the flap for the interior of the cheek.

Dr. Charles H. Peck said that about a year ago he showed to the Society a case of epithelioma of the cheek in which an operation somewhat similar to that of Dr. Haynes was done. The lesion was a very large one, measuring about two and one-quarter by one and seven-eighths inches, and the ulceration had extended

between the buccal folds to their reflections upon the upper and lower jaws. The gap left in the cheek by the removal of the lesion was closed by a flap carried up from the neck, but it was not inverted, as in Dr. Haynes's case. The result was excellent; but there was subsequently a recurrence in the scar, which necessitated a second similar operation, excepting that the flap was carried downward from the forehead. The result of the second plastic procedure was again satisfactory, and death finally occurred from metastases in the lungs.

EPITHELIOMA OF THE TONGUE.

DR. HAYNES presented a man, forty-seven years old, who four months ago first noticed a small pimple on the left edge of the tongue. It gradually increased in size, and on December 11 last he had a severe hæmorrhage caused by ulceration of the process through the terminal branch of the lingual artery. The bleeding was so severe that it was only controlled by passing a mattress suture through the tongue. Subsequently, the anterior two-thirds of the tongue were removed, the excision being preceded by ligation of both external carotids. At the time of the operation the left submaxillary gland, which was somewhat enlarged, was also removed. The stump of the tongue was drawn downward and anchored to the floor of the mouth by means of a deep mattress suture passed through the tongue and floor of the mouth and tied just behind the symphysis so as to cover the large raw surface that remained. Healing had been satisfactory. The man could make himself understood without difficulty.

DR. F. W. GWYER said that a few years ago he had a case of epithelioma of the tongue in which he excised the lateral half of the organ, and then curved the tip of the remaining portion around to the base and stitched it in that position, so that it resembled a parrot's tongue. This gave an excellent result, so far as the power of speech was concerned. A recurrence took place after one year.

LYMPHATIC CONSTITUTION: CARE OF THE LYMPHATICS DURING AND AFTER OPERATIONS.

DR. F. W. GWYER read a paper with the above title, for which see page 641.

DR. JOSEPH A. BLAKE said that a few years ago he read a

paper upon this subject, and had reported seven cases. In three of these death had occurred under ether anæsthesia,—in one under chloroform and in three no anæsthetic had been given. Although the presence of an enlarged thymus was not absolutely essential in this condition, it was of considerable corroborative significance; in fact, all these cases were regarded as instances of thymus death before the general lymphatic condition was understood. The condition of the spleen was also of importance.

Dr. Blake said that in the extirpation of tuberculous glands in the neck or axilla he could recall a number of instances where prolonged manipulation was followed by hyperpyrexia and even by death. In operating on these cases, he preferred a free dissection, similar to that employed in the removal of malignant growths. By the usual method, with blunt dissection, the glands were manipulated a great deal, and their contents squeezed into the general circulation; and this, the speaker thought, caused the infection and evanescent temperature.

Dr. Lilienthal asked Dr. Gwyer how he sterilized the vaseline that he injected into abscess cavities and applied externally before operating for empyema. Personally, he had always been inclined to believe that vaseline, once infected, could not be rendered sterile by boiling without burning it.

Dr. Gwyer replied that he sterilized the vaseline by boiling it for about fifteen minutes over a water-bath. It was then put in collapsible tubes of good size and was ready for use, keeping sterile indefinitely.

Dr. Irving S. Haynes said he had come to the conclusion that in children under four years of age ether was a safer anæsthetic than chloroform, in spite of the fact that the use of the latter was particularly advised by the text-books in those patients. He recalled four cases where the use of chloroform in children under four years of age nearly resulted fatally in his hands. In older children and adults, where there were no contraindications, he preferred chloroform.

Dr. Blake said that the report of the committee appointed by the British Medical Association showed very clearly that chloroform was most dangerous during the first decade of life. This was contrary to the general impression held by the profession. The proportion between the number of chloroform and ether

deaths was much greater before than after the age of ten, and favored the latter anæsthetic.

DR. GWYER, in closing, said he did not wish to have it inferred from his paper that he favored blunt dissection in all cases and at all times, but he thought that the sharp and clean dissection method should not be used exclusively; that there was a place for both in the technique of operations.

STRANGULATED PARTIAL ENTEROCELE THROUGH THE OBTURATOR FORAMEN.

DR. LUCIUS W. HOTCHKISS said that at one of the recent meetings of the Society he had read a paper on this subject in which he reported five cases of Littré's hernia, including both the femoral and inguinal variety. The specimen he now showed was of the obturator variety, and was not recognized before death. The patient was a German woman, seventy-one years old, who was admitted to the J. Hood Wright Memorial Hospital on December 26, 1903, at 2.40 P.M. For a long time she had suffered from cough, and about ten years ago she first noticed a hernial swelling in the left groin. Two days before her admission she began to suffer from abdominal cramps, and twenty-four hours later persistent vomiting had set in. The bowels had not moved for three days, despite purgatives and enemata, and the abdomen had become considerably swollen. Prostration was marked, the body surface cool, pulse feeble and rapid. Temperature was 99.4° F.; pulse, 112; respirations, 40. An examination of the blood showed 8400 white cells. The urine was negative.

An examination of the abdomen showed that the distention was more marked over its lower half; it was tympanitic and moderately tender. In the left groin there was a reducible inguinal hernia about the size of a lemon. The patient was immediately given a high enema containing turpentine and glycerin; this resulted in a large, constipated movement, with much gas. The pain was temporarily relieved. At 8 P.M. the same day the enema was repeated, with a satisfactory result. During the night, however, the patient grew worse, and by morning her temperature had risen to 103° F.; pulse, 110. The pain was more severe. The patient was vomiting and evidently sinking. At 4 P.M. her temperature was 106.8° F.; pulse imperceptible. She died at 4.30 P.M. on December 27, the day after her admission.

Autopsy.—The peritoneal cavity contained about ten ounces of bloody serum. The intestines were injected and the ileum markedly distended down to a point fifty inches from its lower extremity. At this point the gut passed into the obturator foramen on the right side, and below it was collapsed to the ileocæcal valve. The obturator hernia was reduced by moderate traction, and found to be a partial enterocele, comprising about one-half the circumference of the gut, which was strangulated and minutely perforated. A well-defined sac was found, acutely inflamed and containing about four cubic centimetres of a stinking, brownish fluid. The sac was adherent to a mass of fatty tissue.

TORSION OF THE UTERUS.

Dr. John F. Erdmann presented a specimen obtained from a widow, fifty years of age, who gave the following history: She had passed the menopause five years ago. During her early married life she had had three miscarriages, but had never gone on to complete pregnancy. Last August she had an attack of abdominal pain, accompanied by considerable shock, which lasted three days. Some eight months ago she had a second similar attack, lasting two days, and her third attack came on a week ago. When Dr. Erdmann saw her in consultation last Sunday afternoon, she had been suffering for two and one-half days; there were considerable collapse and a temperature of 102° F.; pulse, 126. The abdomen was much distended, and there was a sense of fluctuation over the left side. The condition was regarded as a large uterine fibroid with a twisted pedicle, or an ovarian cyst. Upon opening the abdomen he found that he had to deal with a torsion of the uterus, with its pedicle twisted two and one-half times from right to left. He could not at first make out what this pedicle consisted of, but later, upon investigating, it proved to be the cervix elongated and attenuated. The organ was removed *in toto*, together with its appendages, and the patient made an uneventful recovery.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, January 4, 1904.

The President, RICHARD H. HARTE, M.D., in the Chair.

RHINOPHYMA.

DR. W. W. KEEN presented a man who had been subjected to operation for the relief of rhinophyma. For the accmount of the case, with remarks upon it, see page 665.

THE TREATMENT OF FRACTURES.

DR. GWILYM G. DAVIS delivered an address on this subject, this being the Annual Address in Surgery, for which see page 778.

DR. W. W. KEEN took exception to the writer's commendation of the use of silicate of soda or starch as primary dressings. They will not hold the parts in place until the dressing hardens, and hence allow displacement of fragments. Dr. Davis had also spoken of plaster-of-Paris dressings, but did not specify the mode of their application. If applied simply by circular turns, then they are open to objections, such as interfering with proper cleansing of the parts, massage, etc. If they are applied as splints, they can be used as a fixed dressing, and still be removed to allow of access to the parts. Dr. Keen has recently seen a new form of plaster splint, his attention having been directed to it by Mr. Rebman, of London. It consists practically of a bag one metre in length and from two or three to five or six fingers wide. This is impregnated with plaster, a mesh passing down in the centre to give stability. One can take any amount, six inches to two or more feet, put it in water, prepare it properly, and apply as a

splint. It adapts itself readily to the surface with which it is placed in contact, and thus furnishes a reliable support. This splint is the idea of Dr. Sahli, of Berne. Dr. Keen was glad to hear Dr. Davis speak words of caution regarding the injudicious use of passive motion in the treatment of fractures. In his early career he had under his care cases of Colles's fracture in which he wished to employ passive motion. This he did by flexing the fingers until the hand was made into a fist and then bending the wrist. If any one will try this manipulation, he will readily see what a small amount of flexion of the wrist can be given without causing pain even in a normal hand. If the fingers are straightened, the wrist can be flexed to a right angle with no pain. The surgeon too often forgets the normal limit of movement when he is using passive motion in a fractured limb.

DR. OSCAR H. ALLIS said that Dr. Davis had in his address furnished enough material for a half-dozen or more papers. Any one point, such as treatment of fracture of the thigh or elbow, or massage in the treatment of fractures, would have been sufficient for discussion. He wished to speak regarding simple fractures of the femur. These fractures may be produced in one of three ways: (1) when the force is exerted at right angles to the long axis of the bone; (2) when the force is parallel or in the direction of the long axis; (3) by twisting. In many instances there is an independent fragment of bone. In oblique and especially in spiral fractures where the forces meet there will be found towards the central part of the bone one or more small fragments. In the X-ray we have a valuable adjunct in making a diagnosis. If the surgeon will make use of this and find the exact condition of the injured part, he will enter upon his work in caring for it with far more assurance. It is too true, even lamentably true, that surgeons do not often enough open joints when dealing with fractures that extend into them. In the case of fractures into the knee-joint, the semilunar cartilages may be torn or twisted out of their place, or the crucial ligaments be torn and form practically foreign bodies. Even if the fragments are brought together, there is often a lack of good results in these cases, because the torn structures are pinched between the bones. It should be almost an axiom in fractures involving a joint to open and remove any spicules that may be present. The prevention of angular deformity following fractures of the upper part of the femur is

one of the most difficult problems in all surgery. When the fracture is oblique and can be wired above and below, fixation is possible. When the fracture is transverse, deformity is almost sure to follow even when wiring is resorted to.

DR. DAVIS, in closing, said that it was a very difficult question what to include and what to exclude. He had avoided the discussion of individual fractures and confined his address to the consideration of principles. Regarding Dr. Keen's reference to silicate of soda and starch, he thought there was a misapprehension, as he had not intended to advocate their use as primary fixed dressings. The silicate of soda takes twenty-four hours to harden, and is not immediately adapted to hold bony fragments in position. At the end of ten days, when the parts are fairly firm, this dressing may be used. Starch is not so firm as the former, but helps to keep the turns of a bandage in position and prevents slipping. When plaster-of-Paris is used as detailed by Dr. Keen, it resembles an ordinary splint.

TRANSACTIONS

CHICAGO SURGICAL SOCIETY.

Stated Meeting, February 1, 1904.

The President, E. WYLLYS ANDREWS, M.D., in the Chair.

APPENDICITIS.

DR. E. C. DUDLEY reported a case of appendicitis in a young woman, and showed the specimen. The appendix, which was about the size and length of one's finger, was very much constricted at its entrance to the bowel. After the removal of the appendix and squeezing it with considerable force, a drop or two of pus came out, which contained staphylococci. The lumen of the appendix was almost entirely shut off at its junction with the gut, and, in all probability, would have been soon shut off, and when this had occurred, if pus had continued to form, he thought gangrene of the appendix would result, with rupture of the organ before long.

ACCIDENTAL WOUNDING OF THE URETER IN VAGINAL HYSTERECTOMY; URETEROCYSTOTOMY.

DR. E. C. DUDLEY read a paper with the above title, for which see page 755.

DR. A. J. OCHSNER said that Dr. Dudley had made application of a principle which was not used enough by surgeons. In attaching a tube to any surface in surgical work the same principle could be employed to advantage. For instance, in attaching the trachea through a button-hole in a case of laryngectomy in this way it would not contract, while, if it was sutured to the skin directly, it would. In transplantation of the urethra into the perineum, by making a button-hole and carrying the urethra through and applying the same principle, there would be no stric-

ture at the end of the new urethra. Where one had occasion to attach a tube, which was lined with mucous membrane, as where a long portion of the lower part of the rectum had been excised and the bowel transplanted over the end of the sacrum, where one made the incision as in the Kraske operation, this principle of drawing the intestine through the skin would obviate the occurrence of stricture at the end of the rectum.

DR. JOHN B. MURPHY emphasized the point with reference to opening the bladder. The way in which bladder surgery in the female had been done in the past in the great majority of cases, with only a few exceptions, was through the urethra. Bladder surgery in the female should be done entirely through an artificial vesicovaginal slit, and the bladder opened without hesitation. In the last year and a half he had split the female bladder from the sphincter back towards the cervix of the uterus, turning the bladder out, exposing the ureters, doing any work that was necessary to be done, and sewing up the wound with horsehair sutures, securing primary union in every case except one, and this only required one secondary operation. For the treatment of ulcers of the bladder, papilloma, the removal of stones from the vesical end of the ureter, instead of removing them through an ureterovaginal incision, as was formerly done, the bladder was opened, and its wall was divided in the direction of the bladder to remove the ureteral stones. The incision should be made through the vaginal wall, a probe or director passed into the ureter, and the ureter divided with scissors. Stones and tuberculosis of the lower end of the ureter are usually situated at that particular point in lower half-inch of ureter just outside the bladder. In one case he opened in the other direction and had some difficulty in closing the ureter. Where it was necessary to pull the bladder down with retractors, one could pull it clear out of the vulva and do any work that was necessary on the bladder or ureter through a vaginal incision. There was very little danger of a permanent fistula. The incision was clean-cut. In a case of vesicovaginal fistula following instrumentation in labor, there was necrosis from a crushing injury; hence there was a tendency towards the formation of a permanent fistula, while the tendency in the incision condition was prompt healing of the clean-cut incision.

DR. GUSTAV KOLISCHER said that when he saw the operation described by Dr. Dudley performed, he was impressed with its

feasibility. The operation was conceived in a minute and performed in a short time. That the method was practicable, there was no doubt; and he felt sure it would be employed in similar cases in the future, but whether it was absolutely necessary to operate by this method was another question, that is, fastening the ureter into the bladder after a special incision for this latter purpose was made. In 1898, when the speaker maintained that surgeons should not dilate the female urethra in order to perform endovesical operations, but should operate through an artificial, temporary vesicovaginal fistula, he was attacked rather fiercely, although he could show very good results. It was a personal satisfaction to him to see Murphy take up and recommend rather emphatically this way. The dilatation of the female urethra had been too long kept up, mostly due to the weight of authorities like Kelly and Saenger. He agreed with Dr. Murphy that the danger of a permanent fistula after such an incision hardly existed. There was no loss of substance, and no cicatricial contraction as in obstetrical vesicovaginal fistulas, and primary union after plastic operations would always take place if the lips of the wound could be approximated without any tension.

REVIEWS OF BOOKS.

A TEXT-BOOK OF OPERATIVE SURGERY, covering the Surgical Anatomy and Operative Technic involved in the Operations of General Surgery. By WARREN STONE BICKHAM, M.D., Assistant Instructor in Operative Surgery in the College of Physicians and Surgeons of New York. Philadelphia: W. B. Saunders & Co., 1903.

It is with a feeling of pride that the writer congratulates Dr. Bickham upon his " Text-Book of Operative Surgery." He is proud of the fact that a classical work on this subject has been written by an American teacher. A careful perusal of the work shows but few defects, and it is hoped that the criticisms which are offered will be accepted as being given with the best of intentions.

As a book of reference for the surgeon who desires to refresh his memory as to the details of an operation and the various methods of performing it, this work can be heartily recommended. If, however, it is to be used as a text-book for our medical schools, its curtailment is to be greatly desired.

It seems to the reviewer that if this book were changed so that it were a little more critical as to the value of every operation described, and at the same time omit describing as a separate operation some little difference in technique, it would be a more useful book for both student and practitioner.

The surgeon who consults this work will be astounded at the immense amount of painstaking labor which must have been expended in its preparation. The illustrations, quality of paper, and clearness of text show the highest type of work.

The book is divided into:

Part I. Operations of General Surgery.

Part II. Operations of Special Surgery.

The author begins each chapter with a list of the anatomical structures in the particular region. It would seem to the writer to be far more desirable in future editions to have one drawing illustrating the surgical anatomy of the structure, and a brief description of the principal parts involved, in place of enumerating in detail every artery, vein, nerve, etc., which chances to be in the region. A few diagrams will save much dry anatomical text.

Chapter I is devoted to the subject of ligation of arteries. The description of so many different methods of ligation of the same artery is confusing to the student. By giving one typical mode of ligation of each of the larger arteries, with a brief reference to variations from it, and a critical review of the same, this chapter could be made far more readable. It would also be desirable to have arteries colored in the illustrations. The subject of suture of arteries is treated with great thoroughness. The same spirit of having even the most recent methods painstakingly described and illustrated runs through the entire work, and makes it an absolutely essential one for every surgeon to have at his command.

On page 130 one welcomes a description of how to give an intravenous salt transfusion.

In Chapter III, on the removal of cervical lymph glands, a drawing showing the relations of the vessels, etc., of the neck would seem far more valuable than the detailed anatomical description given.

One misses Cushing's operation for removal of the Gasserian ganglion. A few illustrations of the regions in which neurectomy and neurorrhaphy are most frequently performed is to be suggested.

In Chapter V (Operations on the Bones) the descriptions are explicit and well illustrated. No mention is made of the use of bronze aluminum or iron wire for bone suturing. The use of the Parkhill clamp for ununited fracture could be well omitted. The reviewer would suggest adding some more illustrations of operations for acute osteomyelitis to this chapter.

Chapter XII, on amputations, is to be highly commended. A little less detailed description of the technique of a typical amputation would be desirable.

The author has given in commendable manner the qualifications of good and bad stumps. The only criticism to be offered in this chapter is that there should be a smaller number of methods given, and these more critically.

The same is to be said of Chapter XIII, on resections.

After 457 pages devoted to operations upon bones, joints, nerves, arteries, veins, and lymphatics, the remainder of the work takes up Special Surgery. Here, again, in every chapter the reviewer desires with the best of motives to make the same suggestions. A short description of the anatomical facts of greatest importance in each region, and one or two illustrations of the same quality as those in the remainder of the book, would save what seems undesirable enumeration of structures and relations.

The same criticism in regard to simplifying the number of methods given, and a more critical opinion as to their relative value, holds true for the entire Part II. It would also be desirable to omit the surgery of the eye in this work, except plastic operations on the lids. A few more illustrations of operations for focal epilepsy, cerebral and cerebellar abscess, and tumor are to be suggested. The illustrations in both portions of the book are almost entirely original and faithfully portray conditions at operation. They are executed and reproduced in the most artistic manner.

The term "gut suture" is harsh and superfluous. Obsolete operations, like lumbar colostomy, could well be omitted. The chapters devoted to intestinal suture and anastomosis are classical, but for student purposes must be greatly curtailed. Too much space is devoted to less frequently employed methods of anastomosis.

Bile-duct suture with the Halstead hammer and cholecystolithotrity could be well omitted. One misses in the chapter upon

the rectum a description of vaginal extirpation. The illustrations and description of appendicectomy are excellent.

The reviewer would suggest in future editions omitting the practice of describing as separate operations the same procedure, *e.g.*, hepatotomy, with slightly different incisions. This custom of the author is to be greatly deplored.

Taken as a whole, the medical profession of America can well congratulate the author for his painstaking and thorough labors. It can be most favorably compared with any of the standard European books on operative surgery. Throughout the book one can observe the work of a conscientious and experienced teacher.

DANIEL N. EISENDRATH.

THE TREATMENT OF FRACTURES. By CHARLES LOCKE SCUDDER, M.D., Surgeon to the Massachusetts General Hospital. Fourth Edition. Philadelphia: W. B. Saunders & Co., 1903.

Four editions of this work testify to its popularity. It is an eminently practical work, a work-book on fractures, to which the student may turn when he wishes to know what to do in a given case. The author, moreover, shows him how to do it, and has brought to his aid some 688 illustrations.

The author appeals always for a more general use of anæsthetics as an aid in diagnosis and treatment, especially in injuries involving joints. He takes advantage of the advancements in surgery to apply them to the treatment of fractures, showing how the Röntgen ray has contributed towards a more accurate interpretation of the physical signs of fracture, and therefore to greater accuracy and certainty in treatment. The methods of treatment have been simplified. The new surgery has made it possible for the patient to demand more perfect apposition of fragments, and has enabled the surgeon to resort to the bloody replacement of bones instead of remaining helpless in the presence of irreducible displacements. The results which are being secured

in the open treatment of closed fractures emphasize what anæs-
thesia, antisepsis, and the Röntgen ray can do towards rendering
knowledge of fractures more exact and treatment more accurate.

Dr. Scudder does not encumber his work with apparatus, but
teaches the student to make each case an object of special study.
Instead of dilating upon apparatus and the theories of treatment,
the mind is directed to the actual conditions which exist in the
fractured bone.

Mechanical simplicity is advocated.   The theories of treat-
ment are not discussed.   Many fractures which are extremely rare
are omitted.   It is known that any bone may be fractured at any
place ; and the author has not attempted to describe the treatment
of all the fractures which can be found in the literature.   A
knowledge of anatomy and an accurate observation of fractures,
together with an understanding of mechanical principles, are the
requisites in the treatment of fractures.

We are glad to observe the preference shown to the new
nomenclature in the designation of closed and open fractures.   An
excellent chapter on the Röntgen ray and its relation to fractures
is added to the work ; also some notes upon a few of the more
common dislocations.

The work systematically takes up the regions and their bones.
In addition to the ordinary treatment of these subjects, we find
the treatment of the complications of fractures ; special attention
given to the treatment of fractures of the femur in children ; ana-
tomical facts regarding the epiphyses ; gunshot fractures ; the
employment of plaster-of-Paris, and the ambulant treatment of
fractures.   Practically, all of the illustrations are new.   They are
the most instructive of any set of illustrations of this subject.

This fourth edition is improved by the addition of a number
of excellent pictures.   Additions are also made to the text at
various points.   There have also been added a number of X-ray
plates illustrating the anatomy of the epiphyses.

The author's illustration of the treatment of fracture of the

clavicle is especially to be commended. The statement that complete reduction of Colles's fracture cannot be satisfactorily made without the administration of an anæsthetic, we think is a rather extreme view. Many cases can be reduced as well without an anæsthetic as with it; but we believe that the anæsthetic is withheld in too many cases, and that Dr. Scudder's recommendation will operate in the right direction, even though his suggestion is not altogether in accord with the general experience of surgeons. The general treatment advised for this fracture is such as surgeons indorse.

The treatment of fracture at the elbow in the humerus by acute flexion is well illustrated. The extension apparatus, illustrating treatment of fracture of the thigh, is the most simple and efficient. The car and tracks of the ordinary apparatus are omitted. After the patient is allowed up, the author advises, in ordinary cases, that the free use of the limb without supports shall not be allowed till the end of twelve weeks.

In no work on surgery will the student find a fairer statement of the question of treatment of fracture of the patella than in this book. The non-operative treatment is not complicated by giving a variety of methods, but a simple and rational treatment is described which is applicable to all cases. The operative treatment is declared to be the most satisfactory, and its disadvantages are clearly stated.

In the treatment of fractures of the lower jaw the author is strongly opposed to the ordinary outside splints and bandages, and advises the interdental splints.

This book is well printed and illustrated, and is worthy of the best indorsement of surgeons.

<div style="text-align:right">JAMES P. WARBASSE.</div>

DISEASES OF THE EYE. By L. WEBSTER FOX, A.M., M.D., Professor of Ophthalmology in the Medico-Chirurgical College of Philadelphia, Pa.; Ophthalmic Surgeon in the Medico-Chirurgical Hospital. With five colored plates and 296 illus-

trations in the text. Cloth, $4.00. New York and London: D. Appleton & Co., 1904.

This author again presents the study of the eye in a new dress. There is advantage in this if each new author tries to tell the story for himself from full knowledge. It will differ from that of others, but will be sure to have some points peculiarly meritorious of its own. The arrangement and conception of subject and presentation of it, as to classes of students, in finished crisp chapters, is delightful. It is new to devote a chapter to development. This and that on the anatomy which follows take up the first thirty-four pages. They are well illustrated, and need to be presented thus, because the work is for students primarily. Then follow pages 36 to 79 on diseases and operations on the lids. The operations are so liberally illustrated that the meagre text is still adequate for all the reader's needs. Unusual as it is to illustrate the lachrymal ducts, it is none the less meritorious and praiseworthy; for this is a real point of difficulty. Thus on through the book individuality appears in illustrations, descriptions, and methods of treatment not commonly adopted, e.g., in the illustration and use of peridectomy for pannus and opaque slips for conical cornea, oddly enough even introducing a layman's description in the latter.

The publishers have given acceptable form to it.

Glossary and copious index close the volume. Our conclusion is, that if another treatise were needed just now, this one deserves a place for its own points of excellence. It is not voluminous (only 594 pages) nor exhaustive; but it is eminently practical and plain, and well meets the needs of student readers.

HEBER N. HOOPLE.

MOUNT SINAI HOSPITAL REPORTS. Vol. III. For 1901 and 1902. Edited by N. E. BRILL, A.M., M.D., 1903.

This volume of 575 pages contains the medical statistics of the hospital, and some thirty papers based upon the work of the hospital, by members of the staff.

Under the subject of appendicitis we find in the First Surgical Division a comparison of statistics which shows that in 1898 the mortality following operation was 18 per cent; in 1899 it was 29 per cent.; in 1900, 24 per cent.; in 1901, 10 per cent., and in 1902, 9 per cent. This is explained chiefly by the less severe cases being operated upon in the last two years. In the Second Surgical Division there was an operative mortality in appendicitis, in 1901, of 8.33 per cent., and in 1902 of 8.62 per cent. These figures show that the cases of appendicitis in which the general practitioner calls for surgical help are being placed in the hands of the surgeon at an earlier day than heretofore.

The statistics of operations upon the gall-bladder, strangulated hernia, carcinoma of the breast, the prostate gland, and the kidneys are fully studied. The operations upon the stomach show a mortality of about 50 per cent. Dr. Gerster calls attention to the fact that the patients of the Mount Sinai Hospital are mostly Russian Jews, whose habits, mode of living, and occupations are mainly of a sedentary character. They work in confined places for long hours, and are particularly prone to suffer with diseases of the intestinal tract. Hæmorrhoids are very common among them. The large number of cases of abscess of the liver occurring in these people are attributed to hæmorrhoids. The chain of factors are as follows: sedentary habits in poorly nourished people; hæmorrhoids; traumatism and ulceration of the hæmorrhoids; infective thrombosis of hemorrhoidal veins; thrombotic material conveyed to liver through portal vein; abscess of liver. Strictly scientific proof of this assumption is not present; but it is declared that the ordinarily accepted etiologic factors are absent in these cases, and the hæmorrhoidal hypothesis is the most acceptable.

Dr. Berg has a special article in which he gives a report of sixty-six operations for cholelithiasis. The mortality of 29 per cent. in these operations is explained in the character of the patients from whom the material is drawn. Most of the cases

were ignorant people, far advanced in their diseases, and who accepted operation as a last resort. Thus, out of the sixty-one cases operated upon, nineteen had empyema of the gall-bladder, four had extensive gangrene, six had obstructive jaundice, and practically all had been exhausted before operation by long periods of pain and sepsis. The wretched physical condition of these patients is evidenced by the three deaths from collapse soon after operation.

Dr. Lilienthal has a report of a case of hyperplastic colitis successfully treated by resection of the entire colon, the upper portion of the sigmoid flexure, and four inches of the ileum. Dr. Lilienthal also presents an analysis of his cases of hypertrophy of the prostate, in which he reports seven operations of suprapubic enucleation of the prostate with one death and five complete cures. The fatal case was that of a man sixty-five years old, who was operated upon in an emergency, and in the presence of acute sepsis of the bladder. Dr. Lilienthal's analysis of these cases merits close study. He has shown what the best surgery can do in the suprapubic operation.

The tribute paid to the memory of the late Dr. Paul F. Mundé is a model of memorial addresses.

Dr. Vineberg presents a study of nine consecutive cases of ectopic gestation, and makes the statement that in all but two of these cases there was a rise of temperature. The absence of temperature in these two cases was probably due to hæmorrhage, as febrile movement due to absorption of blood products is a symptom usually present in these cases unless counteracted by the antipyretic effect of acute anemia.

This report, which reflects credit alike upon the surgery and editorial ability of the hospital staff, contains also reports of the work of the pathologists, the anæsthetists, and the X-ray department, and is a valuable contribution to the literature of surgery.

JAMES P. WARBASSE.